Vol. XXIX., No. 2. June, 1903. Whole No. 106.

PROCEEDINGS

OF THE

UNITED STATES

NAVAL INSTITUTE.

VOLUME XXIX.

EDITED BY PHILIP R. ALGER.

PUBLISHED QUARTERLY BY THE INSTITUTE.

ANNAPOLIS, MD.

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The Lord Baltimore Press
THE FRIEDENWALD COMPANY
BALTIMORE, MD., U. S. A.

THE PROCEEDINGS

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U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

THE NEED OF A BUILDING PROGRAM FOR OUR NAVY.

By LIEUT.-COMMANDER JOHN H. GIBBONS, U. S. Navy.

"It is far better to have ideas of only moderate merit carried out in a continuous manner, than to have ideas of real talent applied in a haphazard fashion."—*Le Yacht.*

In 1883, when Congress authorized the first steel vessels to be built for the navy, the country had no settled naval policy. We were imitative and receptive, mere lookers-on in the struggle for sea power. This was only natural, for up to that time our lack of experience precluded a bold striking out for ourselves. Young graduates of the Naval Academy had been sent to the best technical schools abroad, and consequently absorbed in a measure the ideas of their instructors. As the naval architects of England and France led the world, we were satisfied to watch what they were doing, and to reproduce, with slight modifications, such of their types as were thought to be best fitted to our needs. As a matter of fact, there were very hazy ideas as to what our needs actually were, but, generally speaking, the field of a new navy was to be confined to showing our

flag in foreign waters. Such an unexpected thing as a war was to be met by an improvised defense; the words *defensive* and *coastwise* entered into all our plans.

The period from 1883 to 1890 saw our young naval architects, fresh from their studies abroad, working hand in hand with our ship builders, the former bringing the highest standards of foreign practice to serve as a model for the latter in building up a new industry. Furthermore, as our naval architects gained in experience at shipyards, authority was given them to undertake the building of ships at navy yards. This was the great formative period, and while the experience was valuable, viewed solely from the point of matériel, valuable not only to the naval architect but also to the marine engineer, the ordnance engineer, and the electrical engineer, there was no naval policy or fixed building program, around which their efforts crystallized. The result was a multiplicity of types, without any regard to the composition of a battle fleet. A despatch boat, a dynamite cruiser, a solitary torpedo-boat, and a ram, stand forth as minor units from among a heterogeneous collection of "show-the-flag" cruisers and gunboats, but there was an indication of better things in the single armored cruiser. This diversity of types is further explained by the fact that new firms entered the field, attracted by the success of the older shipbuilders; and to foster the industry, ships were authorized, for whose existence there was no other excuse.

In 1890 the first step towards the building of a battle fleet was taken, when Congress authorized three ships of the Indiana class. Ten years' experience had put our naval architects well to the front, and their settled principle seemed to be that for the same displacement, our ships should be superior to foreign ships in battery power. Unfortunately, our naval engineers at this time were infected with the speed craze, and the Columbia and Minneapolis, so-called commerce destroyers, with their attempts to beat transatlantic steamer records, divided attention with the battleships. In 1892 a battleship and armored cruiser were authorized. Then came two years of economy, with river gunboats, torpedo-boats, and a submarine, until in 1895 a superimposed turret controversy ended with the authorization of two battleships of this type, only to break out again the next year, when the decision was reversed, and three battleships of the Illinois class were authorized.

In 1898, the Spanish war came to test, under most favorable conditions, whether our fifteen years of preparation had been well spent. The defensive idea had sunk so deep in the public mind that there came a cry from all of our seaports for protection, and the true principles of naval strategy were badly hampered by concessions to this feeling of timidity. Nevertheless, three squadrons were mobilized, and a weak and demoralized enemy was captured or destroyed. Such expedients as using harbor defense monitors for battleships, and torpedo-boats for despatch boats, or attacking shore batteries with protected cruisers, and even with torpedo-boats, showed a determination, based upon what seemed contempt for the enemy, to put the material on hand to some use. It is needless to speculate now upon what would have happened had we been opposed by a strong, courageous, and determined foe. Public opinion decided that we ought to be better prepared next time, and Congress responded feverishly by authorizing eight battleships and six armored cruisers. Legislative liberality is never systematic, but may always be counted upon in the hour of danger and on the day of jubilee.

Twenty years have thus passed since the beginning of what has been called the new navy. The position of the United States has changed from that of follower to leader. The foreign technical journals of to-day are full of praise for the inventive genius of our designers and builders. Where we formerly rivalled, we now excel. The word *individualism* is frequently used in describing the cause of our superiority. It is high time now, however, that this individualism be brought under proper control, and some attention be given to the navy considered as a homogeneous fighting force. In other words, to have a naval policy, with its corollary, a building program, and understand that the individual exists for the navy, and not the navy for the individual.

The four factors that go to make up a naval policy are:

(1) The political factor.
(2) The financial factor.
(3) The strategic factor.
(4) The matériel factor.

Let us now examine these elements in their application to the naval policy of the United States, and see what they teach us as to the need of a building program.

I. The Political Factor.

Commercial rivalry is the order of the day. Willingly or unwillingly, the United States has entered upon a course of trade expansion. The acquisition of the Philippines and Puerto Rico, the regeneration of Cuba, the expedition to China, and the scheme for an Isthmian Canal, mark this course, along which the country, with little foresight, has been hurried. Pan-Americanism, Monroe Doctrine, Territorial Expansion; these and other political phrases are the outgrowth of trade expansion and not of philanthropic ideals. Our captains of industry have taken the offensive, and national self-assurance has asserted that we are destined to be great. A strong navy is a necessity when we begin to rub elbows with our commercial rivals over seas, and public opinion has been fairly awakened to the reality of "The American invasion."

Unfortunately, the provisions of our Constitution make it difficult to record the will of the people in the form of laws. Congress is an unwieldy body, and by its very composition unamenable to strong central control. Broad policies of the executive branch are frequently stifled by legislative trifling. Take for example the two agitations for tariff reform, which resulted in two victories and one defeat, in a period of twelve years. To-day there is no record on the statute books to show that anything was accomplished, and a celebrated soldier who dubbed the tariff question a "local issue" came very near to the truth. Similarly the navy, to the average legislative mind, is a local issue. The site of a navy yard and the employment of labor therein, or the geographical distribution of contracts for ships, excite far more interest than any executive demand for a strong and homogeneous navy. The reason for this is not difficult to find. Professor Bryce, in his "American Commonwealth," attributes it to a lack of legislative responsibility. In England the Administration stands or falls on the adoption or rejection of its measures, and appeals to the country are frequent. In the United States an unchangeable legislative body exists for two years, a time too short for new members of a lower house to get beyond the local needs of their constituents, and to give their attention to national questions. The result is, government by Committee, and policies are formulated by chairmen, who are selected by seniority, but at the same time

the responsibility rests with the committee as a whole, each of whom must be converted, so that the general unwieldiness is not modified. Under existing conditions, therefore, it is very difficult to carry out a continuous naval policy, or to make the building up of the navy steady and progressive. The only remedy is a campaign of education, and in this campaign the navy has a strong ally in the press. Unfortunately, a partisan bias seems to be a first requisite for maintaining a successful newspaper. In endeavoring to cover the whole field of human effort, and to harmonize information from so many sources, this bias frequently leads to the ignoring of broad principles, and the magnifying of petty details to furnish sensational headlines. In foreign countries naval leagues have been organized for the purpose of constantly agitating questions of naval policy, and educating the mass of the people. A movement for the organization of a United States Naval League has been begun in New York, and if it spreads to other states, especially those in the interior, a wholesome influence upon legislation will undoubtedly be created.

II. The Financial Factor.

A German privy counsellor of commerce, who spent some eight months studying the industrial and commercial conditions in the United States, records his impressions as follows: "The land of unbounded possibilities! The inhabitants of the United States, including Puerto Rico, Hawaii, and the Philippine Islands, number about 88 millions. That is barely 5 per cent of the total inhabitants of the world, according to its highest estimate. This 5 per cent has at present taken possession of 25 per cent of all cultivated area of the earth; namely 407 million acres out of 1629 million of acres." Statistics, to the lay mind, are dry and uninteresting, yet the most cursory inspection of the debit and credit sides of the public ledger shows an enormous excess of receipts over expenditures. In appealing to the business sense of the nation for the maintenance of an efficient navy, the statement is frequently made that the expenditure represents so much insurance. If we follow this analogy, and wish to insure our "25 per cent of all cultivated area of the earth," it behooves the government to set aside each year a certain specific sum for the building up of the navy, this sum not to be

based upon the exhibit of one fiscal year, but rather to extend over a period of years, the period to be determined by our national aims, so far as political acumen and foresight can determine them. To make this point clear we will again refer to the fact that after fifteen years of naval construction, and an expenditure of $123,987,263.00, the Spanish war found us so poorly prepared that a quick and progressive campaign against Havana was impossible. Congress immediately appropriated 50 millions for national defense, and out of this and other funds, the navy expended $17,325,054.00 for the purchase of vessels. Adding this to the amount previously expended, we have a grand total of $141,322,316.00. Taking the average cost of a battleship as $6,000,000.00, this total represents 23 battleships. A more instructive deduction, however, is that this sum could have been expended for the completing of a homogeneous fleet of 8 battleships, and still left in round numbers, over $92,000,000.00 for armored cruisers, protected cruisers, destroyers, and torpedo-boats. The nation that uses to the best advantage the money that has been voted for naval construction, by keeping in mind the military value and economical efficiency of different types, will be best fitted to succeed in the supreme test of War.

III. The Strategic Factor.

When the statesman has outlined his country's aims and the financier has prepared his estimates and made his allotments in conformity therewith, the naval officer's work begins. Considerations of strategy and tactics are of paramount importance, but as we have shown in the brief summary of twenty years' naval construction, they have been a small factor in our naval development. True, we have had policy boards, advisory boards, and the like, intermittent in their existence, but their influence has never been great, and their recommendations, have been considered as more academic than useful.

There was never a more pressing need than there is at the present time for a General Staff,—a staff of officers to formulate strategic plans; a *point d'appui*, behind which should be massed the whole weight of naval influence in public affairs. We already have the basis of such an organization in the General Board, the War College, and the Office of Naval Intelligence. The grand old pioneer, the War College, has survived

attacks from within the navy as well as from without. The General Board depends for its existence upon departmental regulation. A consolidation of all these offices under one head, brought about by legislative enactment, would provide that central naval control so much needed in the building up of a fleet, and the carrying out of a consistent naval policy.

IV. The Matériel Factor.

Although the element of matériel has been placed last in relative importance, the history of the development of our modern navy has always shown that it has wrongfully held first place. This has been due to the faulty organization of the Navy Department, which has a system of independent bureaus, each struggling to leave its individual imprint upon the units of the fleet. It is not unusual, too, to find that some of these bureaus often wander beyond considerations of matériel, and furnish political, financial, and strategic arguments to strengthen their position. Congress is therefore often confused by a multitude of counsellors, and does not always increase accordingly in wisdom. The part has frequently been treated as if it were greater than the whole.

The true position of this element of matériel is readily deduced. Political and financial considerations having determined the extent to which our sea power is to be developed, it is the duty of the sea officers to solve the strategic problems involved, and to make an estimate of the numbers and types of ships necessary to secure the desired end. Then, and only then, should the inventive genius, the technical skill, and the material industry of a country, step in to work for one common cause; namely, the creation of homogeneous groups of ships, each unit of which represents the highest attainable efficiency. Uncontrolled and misdirected individualism never has and never will be successful in any military organization.

Lessons from Abroad.

In 1897, an agitation for the increase of the navy began in Germany. Statistics, showing the growth of maritime interests, increase of population, and increase in foreign trade, were published and spread broadcast, while on the other hand, special

pamphlets called attention to the fact that Germany was behind all the other great powers except Austria and the United States, in naval strength, and that the expenditure for this purpose was very low in comparison with that of foreign countries. This campaign of education resulted in parliamentary action, and a law was passed in April, 1898, which established a definite shipbuilding program, extending over a period of 6 years, and provided for a total strength of 17 battleships, 8 coast defense vessels, 9 large cruisers, and 26 small cruisers,—these constituting a fighting fleet,—while in reserve there were to be 2 battleships, 3 large cruisers, and 4 small cruisers. Another feature of the bill was the provision for replacing old ships by new ones, and the principle was laid down that the life of a battleship was to be taken as 25 years, of a large cruiser 20 years, and of a small cruiser 15 years. In 1900 a more ambitious program was decided upon, and a law was enacted fixing the ultimate strength of the battleships at 4 squadrons of 8 battleships each, with 2 battleships for flag ships, and a reserve of 4 battleships—a total of 38. Besides these there were to be 14 large cruisers, 38 small cruisers, and 16 divisions of torpedo-boats, 6 boats to a division. This program was to extend over a period of 16 years, but as it would be impossible to foresee the political, financial, and technical changes which might take place in that length of time, provison was made for decreasng or increasing the time limit according to these conditions. The result has been marvelous. The program will be complete in 1908, or ten years after the passage of the first act.

England recognized long ago the merits of the group system, and has consistently adhered to it in building up her magnificent battle fleet. Up to 1889 political expediency, and the fancied dictates of economy at any cost, had led to a dangerous complacency, but the "Russian War Scare," and public agitation, aroused the nation in that year to a sense of her true destiny. Small groups of ships gave way to large groups, the two power standard was adopted, and since that time England has gone steadily on, providing for a homogeneous fleet, by a liberality of appropriation that arouses the envy of continental nations. As England is a leader, with the strongest fleet in the world already established, her building program now depends upon the program of other nations. Nevertheless, the annual

additions to the fleet, no matter how small, are based upon the principle that her fleet must be superior in power to the combined fleets of the two strongest foreign navies.

France has dallied so long with different policies that there is confusion in the public mind as to just what position on the sea she aims to maintain. Rational building programs have been proposed only to be abandoned. New designs for ships follow one another in rapid succession, and the idea of a homogeneous fleet seems foreign to the French mind. The political and financial conditions are so fluctuating that the effort to select a moderate type as a compromise with the two so-called schools of naval architecture, seems impossible, and France is drifting towards the condition in which England found her at the outbreak of Napoleonic wars.

Russia has followed the example of England and Germany in bringing forth a building program, and in 1898, after several changes, it was decided to build in 6 years, 8 battleships, 8 large cruisers, and 20 destroyers, but a radical departure was made from the practice of other European nations, in that several contracts were placed abroad, in order that the fleet might be brought up to the desired standard within the limit of time set.

Finally Japan, the new ally of England, set about, in 1895, to provide herself with a homogeneous fleet of 4 battleships, 4 first-class armored cruisers, 3 second-class armored cruisers, 2 third-class armored cruisers, besides numerous destroyers and torpedo-boats. This program has been practically completed, and already Japan is busy with plans for new construction, that contemplates the building, between 1904 and 1907, of 4 battleships, 2 armored cruisers, 4 protected cruisers, 15 torpedo-boat destroyers, and 50 torpedo-boats.

The Factors Compared.

The unmeasurable resources of the United States give her an enormous advantage over other nations, in so far as the financial factor governs the systematic development of a navy. Already England is doubtful of her ability to keep up the two power standard, and in Germany there are constant complaints of the financial burden imposed upon the country by an ambitious naval program. France always pleads poverty as a cause for calling in halt a naval expenditure, while in Russia and Japan

the difficulties that beset the ministers of the treasury in complying with the demands of the naval authorities, are constantly referred to in the press.

With us it is not so much a question of ways and means, as it is one of the systematic allotment of a fair share of the unbounded wealth of the nation to naval expansion. According to the budgets of 1901, the costs of the different navies, per capita of population, was, for England, $4, France, $1.75, United States, $1.10, Germany $0.90.

Similarly the matériel factor need cause us but little concern. Other nations marvel at the industrial progress of the United States. England has been told by an observing member of the royal family that she must "wake up." German methods are proverbially slow, and France will always be erratic. In ship design, engineering skill, and shop practice, we have shown the world the highest results of our tireless will and great capacity for work.

When we come to the political and strategic features of the situation, which from their interdependence may be discussed together, we must part company with the van, and admit that we are far in the rear. Germany stands as the best example of what strong central control can accomplish. The dominating personality of the Kaiser, drawing inspiration from the labors of his General Staff, forces upon the legislators the recognition of the country's naval needs. In a republic this central control is lacking. France has the advantage of a General Staff, but their recommendations are frequently pressed aside by the quarrels of political rivals. Conservative England, with a Board of Admirality that is both strategic and political in character, plods along on the principle that "Evolution and not revolution" is the safest and most lasting method of progress. To England and Germany, then, the one the pioneer and the other the stripling in naval development, we must look for what experience teaches is the proper combination of the political and strategic factors in a naval policy, and only by pursuing a similar course, so far as our form of government permits, will we be able to utilize our financial and technical superiority in building up a homogeneous fleet.

Present Needs.

Since the past twenty years have not given us that position among naval powers to which our industrial and commercial progress entitles us, where does the fault lie, and how can it be remedied? From the considerations enumerated above it is plain that there has been a lack of organization and central control. The remedy is the adoption of a carefully prepared building program, to accomplish this the following summary of present needs, which, while not categorical, covers the more important points:

(1) Strengthen the hand of the executive branch of the government by the creation of a General Staff to study the strategic needs of the country, and to estimate the number and types of ships necessary to carry out predetermined national aims.

(2) Subordinate the techincal bureaus and industrial interests to the proposed plans of the General Staff, so that there may be a continuous building program carried on in an orderly and progressive manner, instead of the present haphazard, spasmodic, individual effort.

(3) Excite a keener sense of legislative responsibility to executive demands, by a campaign of education among the people, through the medium of naval leagues and press agitation, which have proved so successful in England and Germany.

(4) Apportion a proper share of the estimated revenues of the Government to naval expansion, and expend it systematically, the period of construction, for political reasons, to extend over 4 years as the minimum, and 8 years as a maximum.

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U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

NAVAL LITERATURE.*

By CAPTAIN JOHN S. BARNES.

I hope that it is fully understood that I am not here in the rôle of instructor. The modern ship of war and its instruments of destruction, with which you are familiar are unknown to me, and were unknown in the school in which I passed my early life. Captain Chadwick is mainly if not wholly responsible for my appearance, and you must put the blame of perhaps wasted minutes upon him. You have all heard how my old friend and classmate, George H. Perkins, shifted the responsibility of an overstayed leave of absence for which he was being overhauled by Captain Godon, his commanding officer—Perkins was his executive—Commodore Stringham the Commandant of the Navy Yard. Something went wrong—the Navy Department complained to Stringham, who sent for Godon; he was absent. He sent for Perkins; he was absent. The Commodore complained to Godon, and naturally Godon fell upon Perkins, absent without leave, and Perkins suggested to Godon, "suppose we put all the responsibility off on old Stringham." This brings me to say that if any of you have not read Captain Geo. H. Perkins' Autobiography, edited by his sister, you have a treat before you, and it also leads me to anticipate Captain Chadwick's apology for my presence here. A year or two ago he did me the honor of a personal visit, and I had great pleasure in showing him that while out of the navy for many years, I had not lost my interest in it, and as proof, I placed before him a few of the results of upwards of thirty-five years' work in industriously

*Lecture delivered at the Naval War College, 1902.

collecting books, manuscripts and prints, relating to the navy of the United States.

You all know what a "collector" is—or at least you have heard of him—perhaps some of you are collectors, and know the joys, hopes and fears which animate him in the pursuit of his peculiar fad. It runs to all sorts and kinds of things—from the costliest to the most insignificant. Perhaps the collection of books, autographs, manuscripts and prints relating to special subjects has a larger number of votaries and victims than any other form of this disease. There are certain branches of it which are costly and beyond the reach of the collector of moderate means. But any indulgence, when it is carried on persistently is sure to lead to what people without sympathy call extravagance. The first attack of the fever is generally of a mild form—it is usually caught by exposure to or by contact with some fully developed case. It is both contagious and infectious, and is primarily allayed by the occasional purchase of old out-of-print books picked up at second-hand book stores. The mind grows by what it feeds upon, and from old books one runs readily to old prints and thence to autographs and manuscripts relating to the special pursuit. The fever gradually becomes intense, fixed and incurable and takes on the last and fatal stage of illustration and binding.

Soon after leaving the navy in 1868, I came into personal contact with Dr. Emmett of New York, through the introduction of Mr. T. Bailey Myers, whom some of you will remember and all of you will recognize as the father of the late Commander Theodore Mason. Dr. Emmett was a famous collector of "Americana" and possessed at the time of my introduction to him the largest and most complete library relating to the history of America then in existence. It numbered many thousand volumes, nearly all rebound by famous binders in this country and in London and Paris. His extra-illustrated books, enriched by autograph letters and original documents, and rare and curious prints were there by the hundreds. In this particular branch his library had no equal in this country, all devoted to the subject—America. His collections of manuscripts and prints relating to the discovery of the continent, its early settlement, voyages and travels, the Indian wars and Colonial period, the Revolution, were wonderfully complete. He had devoted

forty years of his life to this one object. With a great and lucrative practice, living a modest, retiring life and with an ample inheritance, his income for years and patrimony, beyond his living expenses, were stored upon shelves in the form of paper and ink. His private hospital, famous in its time, was gradually being encroached upon to make place for his treasures. Room after room, piled from floor to ceiling in a building that an hour's conflagration would reduce to ashes. It was in this library that I caught the disease mildly, without the remotest kind of desire to emulate or attempt such a stupendous work. Mr. Myers also was a collector of no small degree, and had at his death a small but unique collection of books and prints, which came to his son, Commander Theodore Mason, and upon his death, his mother and sister presented it to the New Tilden Astor and Lenox Library Association, where they will form a most charming and delightful alcove in what will be the greatest public library in this country. Dr. Emmett has sold only a part of his collection for $150,000 and it now reposes securely in the Lenox Library.

Well, I made many visits and spent hours in Dr. Emmett's library, my temperature rising higher and higher with every visit. I noted that the Doctor had here and there a book, a few prints, and some manuscripts relating to the Colonial and Revolutionary navy, but the navy of the United States seemed to me to play but a very unimportant and unsignalized part of the great collection, and I said to myself, and later to the Doctor and to Myers, "I must make some sort of a collection. I shall go for the navy, it is grossly neglected by the American people now-a-days." Early education and training stand for something; old associations stand with me for a great deal. The good Doctor altho' professionally a curer of disease, in this instance, propagated it, and from that time on injected into my port-folios numerous exclusively naval items that he had found no special place for.

I rummaged the old second-hand book stores, then concentrated for the most part in Nassau street. I spent hours of every available day out of business, searching for old naval histories, biographies, books written by naval officers, voyages of naval ships—I found, at first, that no one had ever undertaken such a collection and at comparatively small expense I got together

in a few years several hundreds of volumes, of which I dare say, very few of you are aware of the existence, all relating to our dear old navy. I also accumulated prints, portraits of naval officers and in the natural gradation of the fever that was in me, autographs. In a few years I became known amongst dealers in this sort of merchandise. Catalogues of libraries for sale, of autographs and manuscripts and auction sales poured in upon me—wherever there was a single item relating to naval affairs. Then I went abroad and resided in Holland, at Amsterdam and Antwerp, off and on for several years on business matters. I found in Holland—particularly in Amsterdam, a perfect gold mine of our old Revolutionary navy; books, prints and manuscripts. Frederich Mueller, then an old man over eighty-five years, an antiquarian, was at the head of the firm which for more than a century had for its business old books and manuscripts. He had made a specialty of Americana, so far as Holland was concerned or interested in the war of our Independence. He was very jealous of them, did not expose them for sale, and had not at that time included them in his yearly catalogues, which are marvels of information and much sought after to-day. I finally succeeded in inducing him to part with some of his most valuable items of the Revolutionary period—letters, prints and old books—several, I may say, a number, of most curious publications in Dutch, French and English, relating to the naval operations of the so-called Colonial ships in English waters, together with a unique lot of copper plate engravings—portraits and scenes of action of the Ranger and Bon Homme Richard, the Surprise and Revenge, some of them unique.

You may reasonably imagine that by this time my recovery from the fever was hopeless—I have it still and shall have it until the end.

On my return from Holland I went into what is considered the last stages—this was twenty-five years ago,—and commenced the illustration feature. I looked around for the best —that is to say—the handsomest edition of Cooper's History of the American Navy, and where do you think I found it?—in London, published by Richard Bently, in two volumes octavo—a large paper copy with wide margins printed on fine paper and in clear type. The American editions were poorly printed on cheap flimsy paper—sometimes in one volume and again in two.

There is also a French edition published in Paris—curiously enough printed in English. Having selected the book, I had it torn into sheets or pages, and enlarged by Trent on Whatman's drawing paper to folio size—between these pages thus enlarged I commenced the insertion of prints and manuscripts—portraits of every person mentioned, autographs and letters of every one, prints of all battles—of all ships, of all places, seaports and maps—newspaper reports of the period. There are very few men whose names are mentioned by Cooper of whom I have not in some way secured either the portrait or the autograph letter—all letters, prints, maps, inlaid, laid down and mounted to folio. The modest pile of enlarged sheets grew to large volume. By handling in such a detached condition there resulted some deterioration and ten years ago I made up my mind to bind them, although I felt that there remained much to be added. I sent the sheets with their additions to Bradstreet and the result is eight volumes folio, with separate illuminated title pages out of the two volumes octavo, and since then I have the material for at least four more folio volumes. They are bound in pigskin in the highest art of American binding, with cases for each volume lined with sheepskin, and while to talk of the cost of anything which one possesses is admittedly vulgar, it may be instructive to know that the binding cost upwards of $400, and the cost of this series has been in the neighborhood of $15,000. I have always regretted that I bound these books, for since the time when the collection was, as I thought, reasonably complete, there has come to me in various ways such a wonderful lot of papers that should be inserted in their appropriate places in the text, that I am compelled to put them in appendices—I suppose it will never end. Unfortunately these late acquisitions are the most interesting and valuable. For years I was on the lookout for a good autograph letter of Commodore Barry and of Captain Conyngham and was obliged to content myself with several unimportant and uninteresting autographs of the former, while of the latter there was not a scrap of his writing anywhere to be found, although I had from Mueller in Amsterdam a splendid folio portrait of him, a copper plate absolutely unique, no other impression of the plate being known. The lettering of the plate designating him as "Le Terrior des Anglais." I also procured from Mueller several other portrait

prints of Conyngham, which will be found in the collection, and several scenes of his exploits in the English Channel. A portrait drawn by some Dutch artist and struck up in the English coffee house in Dunkirk and another showing the English fleet sailing off before the wind, with Conyngham pursuing in a small vessel with a rooster crowing on his shoulder under a flag, supposed to be the flag of the revolted colonies, which was adopted by Paul Jones and by this almost unknown hero of our early navy. These prints created in my mind a great desire to know more of him than appeared in the histories of our navy, but it seemed impossible to find any trace of him beyond what appeared in Cooper, and of course an autograph was apparently as impossible an acquisition as that of Rameses the First. I dwell somewhat upon Conyngham, this unknown Captain, for the reason that one of my greatest joys as a collector of naval MSS. is connected with him.

Cooper relates his exploits in the English Channel in a small vessel which he purchased in England, called The Surprise. He captured several English vessels and brought them or sent them into Dunkirk. The English government complained. The prizes were released and Conyngham imprisoned as a pirate for cruising without a commission from any recognized government or authority. Conyngham claimed that he was regularly commissioned by the Continental Congress as a captain in the navy, that he had sent his commission to Paris to be viséed by the then representatives of the revolted colonies—Benjamin Franklin, Silas Deane and Arthur Lee, but it had never been restored to him. To make a long story short, Conyngham narrowly escaped being delivered over to the English and hanged as a pirate. He was undoubtedly an Irishman, and had never been naturalized, and like Paul Jones, fought with a halter around his neck. Cooper states that, as a result of his researches regarding Conyngham, he thought that he was commissioned as a captain by one of the commissions sent out to Benjamin Franklin in blank, both as to ship and name—leaving Franklin to fill out the blank spaces; but the document being lost and no others having been found, there was no proof of the fact, beyond Conyngham's statements, which if true, made of him the earliest commissioned naval officer of the Continental navy. Conyngham's history is a romance; I cannot

take time to give it to you now but will refer you to his biography, which will soon appear in print, written by a gentleman with whom I am connected by marriage—founded upon papers which have curiously come into my possession. For your present interest, however, I am dealing with this lost commission of Conyngham. A few years ago I received a printed French catalogue of autographs offered for sale by Charavay, a dealer in such wares in Paris. I have received hundreds of such catalogues from all parts of the world—I always study them, or look them over for Americana, and occasionally order sent to me such items which seem attractive if they relate to early American history. Amongst hundreds of items, I came across in this catalogue—one which translated from the French reads:

"Hancock, (John)—Document signed celebrated American statesman, Gov^{r} of Mass^{tts}. Signer of the declaration of Independence: Puce signed as President of Congress—Baltimore 1. March, 1777. 1 p. in fol. obl. 90 f." Suffice it to say that I ordered it sent to me, without any other interest or idea regarding it than that created by the description in the catalogued list. It came duly to hand through a dealer in New York and what was my astonishment to find that it was the lost commission of Conyngham. For 125 years it had been buried somewhere in Paris. Its existence doubted; its loss nearly cost Conyngham his life, and ultimately his loss of compensation for his prizes, for which he demanded year after year relief from Congress. Because he could not produce the evidence of his, it must be admitted, irregular commission by the Continental Congress. Still it was a genuine commission as full and as complete as under the extraordinary circumstances of the period could have been executed or issued. If your curiosity is at all aroused, I beg that you will look at this old document, read its heading, and then possibly you can understand why it excited me. But I am not wholly done with Conyngham. After I got this collector's treasure, the fact become known amongst collectors, and to my intense surprise, there arose from an obscure town in Pennsylvania a person distantly related to Conyngham who possessed a great lot of his papers, letters, journals, documents, accounts of prizes, applications for relief to Congress, reports of Committees, letters of Alexander Hamilton, Secretary of the Treasury, correspondence and no end of

autograph letters of Conyngham, including his daily journal during his imprisonment, in Dartmouth and Mill prisons, in his own handwriting. You may be sure that I did not hesitate to take the lot at the price named by its owner. A few years before I would given the same price for a single authenticated signature. Now any man possessed of the fever and earnestly engaged in the pursuit I shall be happy to supply with the autograph signature of "Gustavus Conyngham," I have a hundred of them, more or less, but I have the complacent reflection that no one else has a scrap of that old Revolutionary hero's handwriting in his possession. His early education had been neglected and his orthography was unique, but expressive—unlike Paul Jones, who got his education God knows where, or how—he had not the gift of elegant phraseology and was a poor penman, but he was honest, truthful and brave—faced many dangers beyond that of battle, and died poor and unrequited, mainly from the loss of this commission and his inability to produce it. I think all his relatives or descendants, except of the remotest degree, have passed into oblivion.

I now come to Commodore John Barry of the early Continental navy. I have some hesitation in talking about him, because I am in some degree related to him by marriage only—so that when the new torpedo-boat destroyer Barry was ready to take her dip into the water, from the shipyard in which she was built, my daughter was discovered by the Naval Intelligence Bureau as the oldest unmarried female descendant of this old Revolutionary commander, for whom this modern example of naval construction was named and was invited and became her sponsor in baptism. For many years, notwithstanding the fact of this remote relationship, while I had found here, and in Holland, a number of very beautiful print portraits of Commodore Barry and had in my possession his original commission from Congress and President Washington and President Adams, also a commission to him signed by John Hancock, I had never been able to find any really interesting autograph letter written by and signed by him referring to his career or exploits during the war of the Revolution. There were none in the market, so to speak,—no collector, not even Dr. Emmett had any. He gave me a bill of lading signed by him, which I eagerly accepted. It is bound in my Illustrated Naval History with several doubt-

ful scraps bearing his doubtful signature. I was mortified and perplexed that in connection with the one man of the Revolutionary navy in regard to whom I might naturally be supposed to have a personal interest, or upon whom my children could base a claim of Revolutionary descendancy, I could not find a word of his handwriting, beyond a doubtful signature to a printed document, and an unimportant letter supposed to be written by him upon some personal business and for which I paid a high price and regarded as unique. You may perhaps figure to yourselves, if you have any interest in such matters, my great astonishment to receive from a Philadelphia firm about two years ago, a catalogue of autograph letters, which included in its numbers several hundreds of Commodore Barry's letters to and from him to be offered for sale at auction on a day or days fixed by the announcement. There were letters to and from him to General Washington and Lafayette, from Paul Jones and to Paul Jones, to and from Nicholson and from a great number of officers of the Revolutionary navy and of the immediate period following the recognition of our Independence. I read over the catalogue with its brief descriptions of the contents of the more important letters—great lots were undescribed and numbered by lot—50 pieces—20 pieces—10 pieces. They comprised a trunk full of the old Commodore's papers—bills and receipts—his letters from his wife—copies of his answers, curious old documents—letters from and to his relatives in Ireland, for he like Conyngham was an Irishman by birth. The reading of the catalogue raised my collector's temperature to the hurricane pitch. I had paid large sums for the most insignificant scraps of his handwriting, and here was his epistolary life laid out for sale to any one who without any particular interest, could obtain probably any number of his letters for a song.

There were only two days before the auction sale commenced. I was in Lenox—I could not discriminate or select—the mail was too slow—I had resort to the telegraph and I sent Sabin, who acts for such diseased persons as myself. "Buy all the Barry correspondence for my account without limit." He of course attended the sale which lasted for three days. There were a great lot of autographs besides the "Barry correspondence." My principal competitors were the agents of the Congressional Library, the Lenox—and other historical collectors—

and prices and bids mounted to high figures for the choice autographs, but Sabin, with a perfectly unwarranted belief in my solvency or accountability, and in the pride and obstinacy which prevails at auction sales, carried off the lot—was the hero of the sale at my expense—I can only add that I don't regret it, altho' I have hardly yet gone through the great mass of old Commodore Barry's papers, which have come to me. It is full of surprises covering the period of the old Commodore's private life and family connections in Ireland; his private family life in this his adopted country, his services in the Continental and Revolutionary navy—his service in the quasi French war, the building of the frigate United States under his supervision—letters from General Washington, Lafayette, Paul Jones, prize lists, accounts of the various actions in which he was engaged. a singularly curious correspondence, letters and answers to and from Commodore Samuel Nicholson, in regard to the pretensions of the chevalier Paul Jones; in his petition to Congress to be made the ranking commodore of the new navy of the United States, and the means taken to defeat his pretensions and the success of them which finally resulted in Barry being the first commissioned captain of the United States navy, Paul Jones' retirement in disgust and his going to Europe and taking service with the Russians.

I may say here in passing, that I agree with the historians that Paul Jones was the romantic character of our Revolutionary navy, and his battles with the Ranger and Bon Homme Richard are almost without parallel in single combats of ships of that or any other period. Buell has made of him one of the most interesting characters of the Revolution, and there is no one who figured in that memorable contest who to-day is so generally known and made a hero of. He had the gift of expressing himself in writing, and he wrote the English language correctly: of all prominent men on our side he was the most voluminous writer, except perhaps George Washington—unlike him, however, he did not hide his light—he had the "fever of writing" and wrote to every one in authority wherever he found himself, and generally upon the subject of himself. He made many private relations of his own exploits and claims for the recognition of his own merits and for reward. Naturally enough I have made great effort to collect Paul Jones—his writings—

his portrait—the scenes of his actions and the numerous memoirs and biographies—they are in great number. The lives are in English, French and Dutch. He is denominated smuggler, pirate, corsair, as well as naval hero. The descriptions of his character vary, all attribute to him at sea great courage and determination arising from different causes, some say that he was not so courageous on land—the French author, who of all his biographers seems alone to have known him personally and intimately, says that he repeatedly refused duels, was shy of his creditors, and otherwise draws an unfavorable picture of his personal characteristics and morals. Later biographers have given much of his voluminous correspondence, and based their estimates of him upon it, and upon his great combats in the Ranger and Bon Homme Richard. Of all the Revolutionary naval commanders his name stands pre-eminent and is best known. He is the only one of that period who wrote letters, and had the gift of expressing himself correctly in good English, whose letters are preserved and have become part of the archives of the government, while a great many are included in the private collections of collectors. For many years however, the letters of Paul Jones have from time to time come upon the market and always fetch the highest prices of Revolutionary autographs at auction sales, or at private sales.

I have a number of them; some bound in my Illustrated Naval History—I intended to have had the pleasure of showing you here one of special interest, which does not appear in any of his biographies or memoirs, which at a competitive sale I secured at a cost of $250.

At the same time, I purposed showing you the original log book of the Serapis commenced on that prize to the Bon Homme Richard, when Paul Jones and his officers and crew left their sinking ship, took possession of their enemy and brought her safely to port. The only instance I believe in all naval annals of such a feat. You may have some curiosity to know how this record has been preserved and is handed down from generation to generation. It is useless to go into the story of that most memorable fight—you all have read about it—and those of you who have been in sea fights, or are familiar with their recitals can appreciate the confusion of that yard-arm to yard-arm battle, between the Bon Homme Richard and the Serapis.

In the abandonment of their sinking ship, some one, possibly Richard Dale or his clerk Fanning carried, with other effects, the blank book of Lieutenant Lunt on board the Serapis. The log book of the Bon Homme Richard went down with her—but with a care which does credit to Dale or his clerk, the official record of the action and the official record of the prize, the list of the officers and men who survived, and the record of her repair and safe bringing into port under jury masts and her final disposition and the disposition of the English prisoners of war are in this log book carefully preserved. The same book contains the log of the Alliance and the Ariel both kept by Richard Dale, in all of these ships Paul Jones' 1st lieutenant or executive officer. In the Ariel Paul Jones finally reached the United States—Commodore Dale retained the log books. Both Paul Jones and Dale left the government service for reasons which seemed good to them, generally speaking because they thought their services were not appreciated by promotion and emolument. Jones went to Europe—Dale took out a letter of marque for a privateer called the Queen of France, named for Marie Antoinette, who had given Paul Jones and Dale interviews, and to whom both had at her request described their battles with the English ships. The log of the Queen of France will also be found included in the log book of the Serapis, the Alliance and the Ariel. It ends abruptly with the end of the war. The entries in the log are all in Commodore Dale's own handwriting—Commodore Dale, as you all know, was restored to the regular navy after its reorganization and figures largely in the early history of the United States navy. His descendants, as happens in the ordinary usual course of our life here, became more or less necessitous or unappreciative of family records, and finding that this old historical document had a commercial value, sold it to a collector of Americana, Mr. S. L. M. Barlow, of New York, who held it for many years. Upon his death his library was catalogued and upon due notice and advertisement, offered for sale. I attended the sale, of course, which lasted for several days, and secured many books which bore upon our naval history—and there were many of them, as well as many MSS.

There was a most decided competition for the Paul Jones Log Book, so named and catalogued—the Congressional Library—

the Lenox Library, several private collectors—all made bids for it—I was startled at the first bid of $500, but it ran up quickly to over $1000, before I could collect myself—there was a contest after that with Mr. Ogden Goelette, but I finally secured it at $1575, tucked it under my arm and with Goelette drove home together in his carriage, each mutually condemning ourselves for our rivalry. I may say here that if it ever becomes known, in Mr. Ogden Goelette's library will be found many rare books relating to early American history. He was, in a way, a collector and had the means to indulge his fancy. But as to that there are many all over the country. This log book, in form and even in expression, is kept in the same manner that all sea log books were and, so far as I know, are still kept: Hours—Kts.—fthms—courses—remarks—commences, and until 4 A. M.—Lat. obsd.—Lat. D. R.,—Long. obsd. and Long. D. R., etc., etc. The remarks cover the evolutions of the ship during the watches, the making and taking in sail, soundings and all the daily routine of a ship of war at sea hour by hour like all logs before and since. The remarks are occasionally enlivened by statements which give some insight as to manners and customs—notably one, when Midshipman Fanning on taking the barometer on the Alliance, during a heavy gale, the ship rolling heavily, lurched up against it and smashed it, whereupon Captain Jones jumped out of his berth, kicked Mr. Fanning out of the cabin, and followed him in his night dress, belaboring him about the decks! I doubt if such an occurrence is possible now-a-days, but its entry in the log, probably with the knowledge of the Captain, shows that in the Continental navy at that period it was a routine transaction, and officially accounted for the loss of the barometer, and at the same time recorded the punishment of the offender. I fancy barometers were scarce in those days. There are other evidences through the logs of these three ships commanded by Paul Jones, that his temper was not of the sweetest.

The crew of the Bon Homme Richard, its numbers and nationalities has always been more or less a matter of discussion in the various lives of Paul Jones. Of course a great number of the killed and wounded in the battle with the Serapis went down in her—besides those killed who were cast into the deep during the fight. But Lieut. Dale in this book has entered the

name and rating of every officer and man who formed the crew of the Serapis when the Bon Homme Richard sank and the place where each was recruited. This list was evidently kept as correctly as possible in view of claims for prize money—but as the Serapis was restored to the English, and the prisoners released, the prize money claims were never adjusted, a fact which in connection with his failure to establish his claims for other prize money and for preferment, constituted the principal causes of Paul Jones' dissatisfaction, retirement from the United States service, and his seeking service with the Russians like the soldier of fortune that he was.

Whatever may be said about him, he was the one romantic character of the war. He and his exploits are known to every schoolboy in the land. In the collection are two of his commissions by the Continental Congress, and notwithstanding the fact that the great mass of his voluminous correspondence is amongst the archives of the Government in Washington, there are a number of his letters of a most interesting character in this and other collections which have never been published.

The portraits of Paul Jones are very numerous. I do not refer to the modern ones, which have made every schoolboy familiar with his features, but to those engraved and printed during his lifetime in England, Scotland, France and Holland: from some one or two of these have the modern engravers taken their inspiration as to features, and added such embellishments as their fancy suggested. Some of the contemporaneous portraits are exceedingly beautiful specimens of engraving and etching art and are rare and costly when found—indeed they do not exist outside of collectors' hands. I believe I have every known portrait of Paul Jones, and one if not two, of which I have never seen a duplicate. No officer of the Revolution was so frequently portrayed during the struggle for independence, not even George Washington.

For the truth of history as served by illustration, I might mention that one of the commonest of the contemporaneous pictures of this hero, represents him in the act of shooting Lieut. Grubb, for attempting to haul down the American colors on the Bon Homme Richard. It exists in large folio—one of Carrington & Bowles mezzotint engravings, colored, and in plain black and white, published as the act directs in 1778—it exists

in a dozen different forms, all of course fanciful. Grubb is called Lieutenant, Midshipman, and Gunner in the lettering—it is safe to say that no such occurrence took place. There was a Midshipman Grubb on the Bon Homme Richard; his name appears in Lieut. Dale's list of officers on the Serapis. He accompanied Commodore Jones to the Alliance and home in the Ariel. From that time he is lost in history, but he certainly never had the honor of being shot by Paul Jones—but illustration has forever connected his name with our Revolutionary struggle.

As to the engravings which purport to represent the famous combat—and you will bear in mind that I am not referring to modern reproductions of illustrating artists and engravers—but the contemporaneous pictures which alone have value to a collector. There are three, mainly in support of Captain Pierson's bravery in fighting with an inferior force the fleet under Paul Jones—representing the Bon Homme Richard and Serapis locked in deadly embrace, while the Alliance under the Frenchman Landais is pouring her broadsides into the Serapis and Bon Homme Richard alike and the English fleet of merchant ships convoyed by the Serapis are finding safety in Carrickfergus. The lettering of this fine plate is in English and French to remind Frenchmen that while the Serapis was captured with her officers and crew, including Captain Pierson, his devotion to duty, against overwhelming odds, was recognized and the Baltic fleet of merchant ships saved. England made a hero of Captain Pierson, and he was as you all know knighted and became Sir Richard Pierson. After his release as prisoner of war, Jones sent him word that the next time he met him he would make a "Lord" of him. This print was published in 1778.

But I must not forget that I am not here to talk about this wonderful and attractive character. You will find it all so charmingly told in Buell's late publication that I apologize for any reference to him, outside of a collector's standpoint.

The other great picture of the battle is a large engraving, almost of the same size, but with the Russian Coat of Arms introduced into the lettering, in English only. It is dedicated to the merchants trading with Russia and published in 1780. Both of these engravings are rare and form the basis of all the subsequent and multitudinous pictures of the contest. The latter

is of extreme rarity. I have never seen or heard of a duplicate—somewhere in England will be found the oil paintings from which these engravings were made.

I must close the Revolutionary naval talk with the remark that besides Barry, Jones and Conyngham, there is hardly one of the men who are mentioned in Cooper's Naval History as of this period, of whom I have not either a portrait, or an autograph letter or both,—officer or civilian—at home or abroad. Naturally enough throughout I have made no special objective of the Continental navy—altho' that would have been, had I known it, enough work and more than I contemplated at the outset.

Passing through the period of idleness and really disorganization of the navy immediately succeeding the cessation of hostilities, we come to the quasi war with France, in which figured conspicuously Commodore Barry, Commodore Truxtun, Commodore Barney, Commodore Bainbridge and others.

The books, manuscripts, prints, portraits and memorabilia are scarce, but all the more interesting on that account. There are many private letters of Truxtun, who wrote easily in good English, and was a voluminous correspondent. His handwriting was in the expression of the day "elegant." I have dozens of his letters all having more or less reference to his exploits during the quasi war with France, also a number of the letters of Joshua Barney and Bainbridge, Barry and others, who figured at that period, with of course portraits and prints of the battles in which The Hyder Ally, General Monk, the L'Insurgente, Boston and Berceau figured. There is also a lot of MSS. concerning the capture of Bainbridge in the Retaliation by the French squadron, his temporary imprisonment at Guadeloupe, all described in private letters of Bainbridge and in his correspondence with the governor of that island.

The Tripolitan war follows, and forms one of the most interesting periods of our naval history, in which figured as young officers nearly all the men who subsequently, in the War of 1812, gained great renown for our service, and lasting honor for themselves. Preble, Decatur, Hull, Bainbridge, Barron, Lawrence, Perry, Dent, Trippe, Somers, Biddle, Henley and numberless others—I cannot enumerate them. The war with Tripoli is filled with incidents which have formed subjects of much writing,

both by the actors in the scenes themselves and by public officials. In the collection will be found a great many autograph letters, original documents relating to them, as well as every obtainable print illustrating the capture and the recapture of the Philadelphia—the bombardments of Tripoli, the adventures of the Intrepid—scenes with the Bey of Algiers and the Sultan of Turkey, etc. The portraits are also complete or nearly so. The correspondence, including that of Bainbridge and the Danish Consul, Nissen, and the representative of the French Republic, under the dictatorship of Napoleon, who befriended him and his fellow prisoners during Bainbridge's confinement in the Barbary state prisons, some of the secret correspondence with Commodore Preble—all are found in the collection—and would I am sure, could I dwell upon them, interest you.

Indeed a complete history of this period has never been written more fully than in Cooper's History, where its features are sketched most hastily. I may say here that there is now held by Messrs. Dodd, Meade & Co. of New York, a collection of letters and documents relating more particularly to the war with Tripoli, comprising the private and public correspondence of Commodore Edward Preble. There are fifteen or twenty volumes of it, roughly but consecutively arranged, by being pasted into large blank books. They would be indispensable to any one undertaking to write the story of this period of our navy. It may give you some idea of the commercial value of such relics when you know that the owners, some descendants of the Commodore, ask $10,000 for the papers. But it has been intimated to me that they could possibly be purchased for $7000. There are a great many individual letters and documents for which I would pay large sums, but the collection cannot be separated and is held as a whole—it should go into the public archives at Washington.

Coming to the period embracing the War of 1812, the field for the naval collector is at once enlarged and expanded. Following that war and during it, writers in England and America were busily engaged in writing histories of the War of 1812, naval biographies, accounts of participants, discussions of causes. pamphlets, personal experiences, cruises of particular ships of war or squadrons, charges and counter-charges, relations of the

several conspicuous battles which occurred, written by numberless actors who viewed them from different standpoints, all these publications appeared in print, here and in England and sometimes in France, while artists and engravers on both sides illustrated every prominent person and incident. It was not, thirty years ago, a difficult or costly work to collect the War of 1812. Every second-hand bookstore and print shop in London, New York, Boston, Philadelphia and elsewhere, had on its shelves old worn out, dilapidated, well thumbed and often badly printed books and prints relating to the subject.

With each succeeding year the items became more rare and more expensive. Other collectors sprung up, the old books disappeared and to-day I dare say that amongst the rarest of this past century's Americana will be books relating to the American navy and its exploits up to and including the War of 1812 and perhaps the Mexican War.

I have referred to old, out of print books and their generally dilapidated condition—the bindings originally of the cheapest character—leaves dirty and stained, all have been handsomely rebound in crushed Levant, the texts cleaned and restored. There is not, I believe, a single officer or civilian, mentioned by Cooper connected with the War of 1812, of whom I have not portraits or letters, or both, not a single illustrated scene described by him of which I have not an impression. Searching through the shops in England I have often secured portraits of English commanders of the various ships with which our ships came into contact, and often their biographies, which has resulted in some most interesting discoveries of books, letters and prints. I wish I had time to particularize some of them. Of the more prominent naval commanders of the century, Hull, Decatur, Jacob Jones, Bainbridge, Lawrence, Rodgers, Chauncey, McDonough, Biddle, Burrows, Perry, Morris, Stewart, Porter of Essex fame, Warrington, Percival, Read, Smith, Truxtun, Dale and many others, I have many portraits and many most interesting autograph letters, the latter all relating to their profession and exploits. Besides the portraits of the Naval War Committees of the Continental Congress and their autographs, the collection includes the likeness and autograph of every Secretary of the Navy—not merely autographs, but letters written and signed by them, generally private, but upon subjects connected

with the administration of naval affairs—but few that may be classed as public documents, or that have been printed in the public archives.

I do not wish it to be understood that I have in any way exhausted the supply of such things—they are yet to be found by diligent and persistent search and watchfulness, and surprises come when least expected and they crop up in the most unexpected way and from most unexpected quarters. The demand and willingness of persons to pay for historical memorabilia increases every year. There are hundreds of collectors all over the country where there was one, thirty years ago—of every relic of our nation's history—while the great libraries are the repositories forever of individual efforts and are constantly absorbing the rarest and most valuable.

I may, however, congratulate myself that I have perhaps the largest and most interesting collection of books, manuscripts, autographs and prints relating to the old navy, for I believe I was the first one to devote himself specially to this special branch of Americana.

To illustrate the eagerness of this general fever, and at the risk of wearying you with the subject, and of a charge of egoism, I will relate a circumstance of my personal experience. After graduating at the Naval Academy in 1854, I made cruises in the steam frigate San Jacinto, Captain Stribling, the sloop-of-war Saratoga, Captain Tilden, and the surveying steamer Arctic, Captain Berryman—in the last named, making the first line of deep sea soundings across the Atlantic from Trinity Bay, Newfoundland, to Valencia Bay, Ireland, in the interest of the contemplated first Atlantic cable. During all of these cruises, I kept, as required by the regulations, copies of the logs of the several ships, to present to the board of examiners, for my promotion to passed midshipman. On the return of the Arctic to New York, amidst the confusion arising from the sudden putting out of commission of the ship, during my temporary absence on shore, my log books were stolen, or lost. I was at once detached from the Arctic with orders to proceed to Annapolis and report to the board for my examination—all the surviving members of what was known as the advanced class of 1851. Selfridge, Miller and Stribling were there. The first question propounded to me was a request to present my journals and letters from

my commanding officers. I explained the reason of my inability as to the journals or log books. Their disappearance was unaccountable and my excuse was not well received, particularly as Captain Stribling in his letter to the board while commending my general conduct on the San Jacinto, called the attention of the board to the fact that I had failed to keep the log of the ship as required by the naval regulations. This I explained by the statement that I had not presented it to him, as he left the ship in charge of Lieut. Overton Carr, his executive, a week or more before the ship was put out of commission, and I had therefore presented my log book to Lieut. Carr, who had signed it "Examined and approved." Well, the board refused to examine me and I had to go to Washington, see the Secretary of the Navy, make a formal statement in writing, use all the influence I could bring to bear and after some days of doubt and unhappiness, I secured an order from the Department directing my examination. I had, however, fortified my statements by a letter from Lieut. Carr, stating that he had seen, examined and approved of my log of the San Jacinto. My examination came off successfully and I received my warrant as passed midshipman in due course. Now you will naturally wonder why I should go into this trivial story, taking up your time and my own. Last March of this year I received a letter from a fellow collector, member of the Historical Society of Pennsylvania, calling my attention to the fact that in Professor Osgood's Catalogue of the archives of the State of New York, just published by the Government Printing Bureau at Washington, appeared this item—"Journals of John Sanford Barnes, Midshipman in the Navy of the United States, of voyages made in the U. S. S. ships-of-war, San Jacinto, Saratoga, and Arctic, 1854, 1855-1856." So here in great dignity were my long lost log books, reposing amid the archives of my own State.

The State archives are in charge of the Regents of the University of the State of New York. To them I applied stating the circumstances, asking that the journals be restored to me; after much correspondence, and upon my offering in exchange some other material, these journals came back to me after forty-six years of disappearance. Upon investigation it was found that my journals were purchased from Henry Stevens in London over eight years ago, together with a lot of Americana, for

which the State had paid the sum of $2500. Mr. Stevens was a noted collector and dealer in matters relating to American history and had resided for many years in London. He has joined the ranks of the great majority and I shall never know how he became possessed of these journals, dignified as "archives" during the lifetime of the writer of them!

You may possibly imagine that the reading of Professor Osgood's archives, a copy of which, with some difficulty, I obtained, was somewhat like reading one's epitaph on one's own tombstone. Their interest to Mr. Stevens probably arose because they covered interesting items of American history—the Crimean War, the Ostend Conference and the laying of the first Atlantic cable.

I must beg your pardon for this long, disjointed talk, but as I have said before Captain Chadwick is responsible for it. I put all the blame upon him and I beg for him your most indulgent consideration.

You may well ask what does all this fumbling with old papers amount to anyway? How are we to be instructed by it? What has the Naval War College to do with such past and gone matters? We are interested in the present and future development of the new navy—monster guns, monstrous steelclad ships, swift protected cruisers, steam power, electric power, smokeless powder, rapid fire artillery, torpedoes, torpedo-boats and destroyers, naval problems and naval strategy; those old ships and old sailors are extinct as the ark with its navigators, they can teach us nothing. I can only say that they may be inspiring. I remember well that upon visiting the museum of the United Service institution in London, and again the army and navy exhibition at Earl's Court, I was overwhelmed by the grand collection of evidences of English prowess upon the sea, in the form of portraits, paintings, prints and manuscripts, captured flags, relics of famous men and famous battles of the British navy, among them the spoils of the Chesapeake and the President, which gave me a pang of regret and envy.

Such an institute and such exhibitions may be impossible to us now, but we have made some histories creditable to the country and to our service, we are adding to it yearly, in the course of human events we are likely enough to add more to it. Scattered about the navy yards, and the Naval Academy and in

the Department at Washington and in private hands, in public museums and libraries, are the relics, monuments and trophies connected with the naval and military history of the past. They have no collective force and exercise no inspiring influence upon the people. Can they be brought together, classified and arranged, somewhat in the form of the United Service Institution of England, or the Naval Record Society of Great Britain? Those of us who have visited the great international exhibitions of recent years, know how the people flock about governmental exhibits, illustrating the progress in armaments and their manufacture. In London, in Paris, in Berlin, and in Vienna, and in St. Petersburg, exist great historical collections of arms, and in their libraries classified collections of military and naval literature. Here we have no such purpose anywhere evident or anywhere suggested. It is impossible without governmental interest and expenditure to approach within long gunshot of these foreign collections, but something might be done in this direction and that is a problem for the Naval College to think over, discuss and suggest, or to abandon as a matter beyond its scope. I can only say that were such a commencement made of a Naval or United Service Institution, or Naval Record Society, I would see that ultimately the results of my work as a collector of naval memorabilia should find a final resting place there.

Of course the war records now being published by the Government furnish every kind of *official* report of the war between the North and the South, but all such official reports are but dull reading compared with the private descriptions and personal experiences of prominent individuals, who were active participants in the scenes of the war. Biographies and autobiographies of naval officers are needed, and it should be the object of a record society to stimulate, or induce such personal reminiscences, particularly of those officers now on the retired list, who are passing away with all the treasures of their memories.

The records of services of officers can always be found at the Department by any one having special interest and the industry to dig them out of the departmental files. They are seldom of use except perhaps to be referred to in a general way by officers in trouble. There have been several attempts to collate the records of officers, like Hammersley's record of the graduates of the Naval Academy; it is a cold, rigid formal memorandum of

dates, commissions and orders of officers named. Hammersley probably found that as to living graduates his easiest and surest method was to apply to the officers themselves for information regarding their services and it shows the interest which officers probably take in the service that in response to his inquiries he received hundreds of letters from those he addressed giving briefly their autobiographies. He kept all these letters, filed them in some order in scrap books, and it may interest some here to know that I finally purchased these books and have of some, if not of many of you here present, your own estimates of your personal services in your own handwriting. Hammersley condensed these autobiographies and printed them in his book. It is imperfect. Indeed you may suppose that I do not estimate the publication highly, valuable as it is, as my own name does not appear in it! The scrap books however, are extremely valuable, and will become more so as years roll by.

When I threw upon your president, Captain Chadwick, the responsibility of appearing before you, it was with the intention of sitting amongst you and having a quiet and informal chat about the old navy, but when I came to think of it, I found that I might ramble on interminably on my hobby-horse, until your patience gone, you would politely cough me down and shut me up. So I thought it best to condense my remarks by writing out and reading them to you. I fear that learned as you are in processes of condensation, you'll find these hastily brought together and tedious recitals rather of the triple expansion order.

In conclusion I may be permitted to say that I have written this ill prepared talk entirely from memory, separated from my library and collections, with very grave doubts as to its interest, except perhaps to those curious in such matters.

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U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

NAVAL INTELLIGENCE DURING WAR.*

By CAPTAIN C. F. GOODRICH, U.S.N.

INTRODUCTORY.

The President of the War College has honored me with an invitation to address the members of the class this year on two subjects with which I was particularly concerned during the war with Spain, viz.: scouting and cable-cutting. No very profound investigation is required to show that these two subjects are as closely allied to the general topic of intelligence as the obverse and reverse sides are to the medal which lies between them. I have found it so difficult to isolate them from each other and from the larger branch of naval activity of which they form a part, that I have been led to pay some attention to them all. The object of scouting is to obtain intelligence, the object of cable-cutting is to destroy or rather to interrupt intelligence. What, then, is intelligence? How may it be secured? And how may its transmission be prevented? It would seem as if the answers to these questions ought to justify some consideration on the part of naval officers.

I purpose, therefore, to discuss in my four lectures of this year, 1st, naval intelligence during war; 2d, scouts, their nature and employment; 3d, scouting as exemplified in history; 4th, cable-cutting.

I beg that you will accept my remarks as suggestive merely. I do not care to dogmatize, nor, indeed, am I always so sure of my conclusions, as to wish to impose them upon others. On the contrary, I shall be gratified if what I say arouses a vigorous

*Lecture delivered at the Naval War College, July 28, 1902.

discussion even if the result of that discussion be the complete refutation of any or all of my views. We are here to get at the truth, to extract the kernel; each of us must be open to conviction, and ready at all times to admit that through another's speaking, "è l'argomento casso," as Dante says.

I trust you will pardon me if I claim an importance, second to no other among an admiral's concerns, for information, or for what in a general way, is termed intelligence. The Intelligence Department is the eyes and ears of the commander-in-chief. Through it he sees and hears. Without it he would be as one blind and deaf. Nothing becomes clearer as we study the history of maritime war than the admiral's absolute dependence upon correct and frequent information for the right use of his fleet. The wonderful strategic intuition of Nelson is too rare to be counted upon with certainty as in the mental equipment of our flag officers. And it is entirely proper to recall to mind that while, in the two great chases after the French fleet which led to his victories at the Nile and off Trafalgar, he jumped at a conclusion and devined this enemy's objective, he would have been spared many weeks of care and several thousand miles of sailing had his sagacity been supplemented by the accurate knowledge which modern science, skillfully employed, could now place at his disposal. The haphazard methods of former days will no longer serve.

It has been convenient in the preparation of these lectures to assume that warlike operations are to take place within or not remote from our own waters. Under these circumstances, we shall be, naturally, at a military disadvantage through possessing the inferior fleet, and we shall, therefore, be compelled to make the very best possible use of our resources. A scheme which will work satisfactorily under less favorable circumstances may be confidently relied upon when the balance of conditions lies upon our side.

Intelligence in its right development can only be had by selecting for it an officer of sufficient rank and great natural and cultivated aptitude, providing him with the necessary subordinates, clothing him with the requisite powers and then holding him to sharp responsibility. Call him, if you please, the Fleet Intelligence Officer, and place at his disposal all the means which ingenuity can devise for ascertaining what the enemy is

doing or planning; thus only can be secured a service at once rapid and exact.

Let us enumerate his possible sources of information with a view to establishing methods by which they may be utilized. They are:

1. The files and channels of the Office of Naval Intelligence.
2. Spies in the hostile territory.
3. Agents, either special, consular or diplomatic in countries adjacent to the enemy.
4. Casual letters or despatches received by citizens at home.
5. Reports from merchant ships.
6. Reports from signal stations along the coast.
7. Scouts.
8. Cruisers.
9. Pilots.
10. Miscellaneous accessory sources.

It would be a work of supererogation to describe the variety and extent of the information which the Office of Naval Intelligence is in a position to supply. As to the matériel and personnel of foreign fleets its archives leave little to be desired, so complete and fresh are they. For operations restricted to our own waters, the Office of Naval Intelligence suggests itself as filling the want briefly outlined above. In that event, it should be as completely subject to the commander-in-chief as any vessel of his command. For operations abroad, its rôle would be more or less predominant according to circumstances of time and distance.

Spies.

By far the least satisfactory will be the intelligence received from spies, for the reason that spies must ordinarily be bought, and persons animated by sordid motives are not over trustworthy. Still if the statements of spies are carefully sifted, regard being had to their questionable origin, and contrasted with news otherwise obtained, they will often be useful; indeed they may prove invaluable at times when nothing else is to be had and when, too, as is possible, the spy is an American or is known to be actuated by covert friendliness to our cause.

Spies are by no means invariably of the vulgar, grimy, repulsive type best known through fiction. They may indeed be

men in good social standing who have allowed their tastes to outrun their resources and who, too weak to practice the self-denial needed by their salvation, are fain to add to their incomes by friendly tips received in exchange for information which comes to them through family or official connection. The progress from telling of things that are not important to divulging secrets of moment is steady if slow.

Their reports should be sent to some inconspicuous individual on neutral territory, preferably by mail, and the gist telegraphed by him to the agent (say in New York) of the Fleet Intelligence Officer.

A separate telegraph code should be prepared for each forwarding agent. A large number of commercial codes are in existence that can be employed to advantage. Each is provided with blank words to which any desired significance may be attached. These codes are abbreviatory only and not secret except so far as special meanings are attributed to special unassigned words. They are well known to telegraph operators the world over and hence despatches sent in their phraseology would not attract attention.

It would be well in the report to convey directions as to an assumed ordinary business transaction and then slip in a few additional words pregnant with news.

If the New York agent were a well known commission house it might receive a despatch of seven words such as this:

Oblivious. Ship us by sailing vessel the number of bales of Sea Island cotton mentioned below and draw on us at 60 days —price and freight rates as per your letter of undermentioned date.

Smilax. 50

Superior. January 25th.

Pendant. The enemy despatched yesterday a squadron, destination Halifax. It is composed of —— battleships, —— cruisers and —— torpedo-boats as follows, respectively:

Syntax, eight.

Similar, ten.

Standard, twenty.

The operator is accustomed to take every day such messages by the score, where a part of the meaning is open to any one ready to spend a few dollars for the code book and the rest is confidential between the sender and the receiver.

It is lucky for us, by the way, that all submarine cables from the United States to Europe do not land in one country exclusively.

The New York agent would simply forward to the central Intelligence Office the despatch as received. He should not possess the key. It is needless to say that the order for the fifty bales of cotton is apocryphal.

It is difficult to formulate the instructions that should be issued to spies beyond the injunction to report facts that bear on the subject and to pay heed to rumors in only exceptional cases. Much depends upon the individual character, of course. From a workman or draughtsman, in a foreign dock yard, we should expect a very restricted range of news; from a subordinate clerk in a foreign ministry of marine a little more; from an employee of higher grade a commensurately wider range. Definite intelligence alone should be paid for. The newspapers may be trusted to chronicle the current rumors.

There is another class of spies who have, in times both remote and recent, shed honor on the American name and nation. I am sure I but voice the Service's universal sentiment when I congratulate our colleagues Ward and Buck upon not sharing the fate of the no more patriotic and devoted Nathan Hale. Passing from the sentimental to the practical, I need only remark that such spies as these need no instructions beyond the general injunction to see and report.

Intelligence Agents.

A certain amount of useful information can be had through the interest and tactful activity of our consular and diplomatic bodies in countries adjacent to the enemy. The State Department is the channel through which such communications would flow. To supplement these sources the Chief Intelligence Officer might employ directly one or more persons in the localities mentioned. Inquiries emanating abroad would excite less suspicion than those originating at home.

Naturally there will be great multiplication of similar reports, but it will be far better to get too much than to run the risk of getting too little.

Casual Information.

The Fleet Intelligence Officer might cause it to be generally known that persons receiving, through letters from abroad or otherwise, news relating however distantly to the military and naval preparations or movements of the enemy are requested to communicate this news to him without delay as a patriotic duty incumbent on all Americans. Oftentimes people get hold of useful facts but do not know where to send them.

It is not likely that very fresh or very valuable items will be secured in this way, still the chance should not be neglected. We must take steps to guard against the subsequent regret for having omitted any one precaution, however seemingly unimportant and trivial.

Reports from Merchant Ships.

The customs officials board every incoming vessel. Where there is no naval patrol, the treasury department would doubtless, on request of the Navy Department, interrogate captains and others on board of arriving ships as to what they had seen and heard both at the port of departure and *en route* bearing upon the question of approaching or actual hostilities. Even coastwise craft should be subjected to like enquiry.

Should any American vessel sight the enemy at sea or obtain from hailing other ships, or indeed in any manner, information that might be of value, the captain ought to run for the nearest signal station and there report; or else communicate with the naval or customs authorities in the port of arrival.

Signal Stations.

The establishing, equipping and manning of signal stations along the coast should be unreservedly in the hands of persons under the control of the Fleet Intelligence Officer.

It may be confidentially predicted that light-ships will shortly be provided with wireless telegraphic communication with the shore. There is an obvious drawback to the use of light-vessels and light-houses as signal stations; if so employed they take on a belligerent character and abandon all claim to exemption from destruction by the enemy. So impressed was I with the desir-

ability of preserving this neutrality that when, just prior to the late war, I inaugurated the coast signal service, I took pains to locate signal masts and shanties quite apart from the towers of the light-house establishment. At every important headland or outlying island a station should be erected and connected telegraphically with the intelligence centre, of which I shall speak later. A signal mast and yard should be erected and signals, either flag or shape or both, should be provided as well as lanterns for night use. The international code would be used in communicating with merchant vessels, a special private code with men-of-war. The devising of this code should fall to the Fleet Intelligence Officer. Every life saving station would be used for observing and reporting.

During the war with Spain, the naval militia manned the coast signal stations so promptly and efficiently as to earn the admiration of all cognizant of its activity. After establishing the various stations, some thirty odd in number from Monhegan Island, Maine, to Galveston, Texas, I turned the command over to Capt. T. F. Kane, U. S. Navy, and he in turn to Capt. J. R. Bartlett, U. S. N., whose full report may be found in the Report of the Secretary of the Navy for 1898, Vol. I, page 386 *et seq.*, with all correspondence relating to the subject. It is well worth the reading.

It would appear safer to use these coast signal stations as mere transmitting offices whose duty it is to forward the signals as received—the key to the private code not being in their hands. Against this it might be urged that the station would be in ignorance of the meaning of some vitally important message and would be unable to discriminate as to what information it should repeat to war vessels running in for news. But this objection may be met by the central office wiring to each station the signal it should make to communicating vessels either in secret or open code according to circumstances. It is of the most importance to guard the key as closely as possible. It must of necessity be given to every cruising vessel and to the secondary base and central office. As far as practicable is should be withheld from every one else. The enemy will have his spies among us and this key will be greedily coveted. He will spare no pains nor expense to secure it.

In a general way I may remark that it is not necessary to specify

the location of these signal stations; they suggest themselves at once.

As to the signal code to be adopted, I have but few suggestions to make. The flags of the international code commend themselves to our favor through their acknowledged visibility. Moreover they can be procured quickly at any large port. If used with a private signification, a predetermined code flag should be displayed.

Hoists should be limited to as few flags as possible. Each signal station should have a list of all vessels' distinguishing pennants. A record should be kept at the signal station of every sail seen, its description, flag and course, and of all messages received and sent. This record should be weighted and thrown into the sea or otherwise effectually disposed of before the enemy can seize it.

To extremely important stations (such as Cape Cod) a naval officer should be attached.

Speaking of the manoeuvres of 1889, a writer in the *Ed. Rev.*, Jan., 1890, points out the advantage, to the defense, of the possession of accurate and frequent information by telegraph. One squadron of the B fleet had gone around Great Britain but was discovered August 24 from the coast; of outlying cruisers or scouts in that direction there were none. The news reached Admiral Tryon off Falmouth in the evening, and he immediately despatched Admiral Tracey with a force sufficient to give an account of them. On Sunday afternoon, August 25, Tracey passed through the Downs; on Monday morning he was off Spurn Head, being all the time continually informed of the enemy's actions and movements. A few hours later he learned that a powerful reinforcement for the enemy, the Inflexible, had passed through Pentland Firth. This rendered the B squadron superior, and Tracey fell back to wait for reinforcements which he knew would be immediately sent him. They joined him on Tuesday evening and on Wednesday morning off Scarborough, he knew he was close to the enemy, whom he could not see by reason of a fog. * * * Tracey, in fact, not only knew that the B squadron was in his immediate neighborhood, but knew its exact strength and that it was inferior to his own. "When the fog lifted, D'Arcy Irwin, commander of the B squadron, found himself in the presence of a much superior force. He turned to fly,

was unprepared and lost two of his best ships." Nothing could more clearly illustrate the enormous advantage which the telegraph gives to the defense.

Reports from Cruising Vessels.

Every ship in commission should have a list of the established signal stations. When running in to report or to obtain news she should display her distinguishing pennant and the code flag. Great saving of time can be effected by the free use of these stations. Thus a scout might report at one station and at the same time ask that further instructions be sent to her at the next station in the order of her cruising. A single flag would ask this question, "Have you any orders for me?" and another would reply, "Instructions received to notify you that your cruising orders remain unchanged."

Pilots.

Pilots enjoy unusual opportunities of gleaning intelligence from incoming craft. For this reason, if for no other, the Fleet Intelligence Officer, either in person or by deputy, should be on intimate relations with their whole body, and every pilot should be requested to report at once such news as he can gather.

It should be the duty of the Fleet Intelligence Officer to have on record an accurate description of every licensed pilot with a full account of his knowledge of his own port and the adjacent waters, with, and especially without, aids to navigation. Additional lists should be made of various localities, that might be sought by the fleet or by single ships, and of the men whose local knowledge might be useful in navigating those parts.

In spite of the general bad reputation borne by pilots—with us largely due to d'Estaing's experience at New York in 1778, and to Nelson's scathing strictures—I think that some of the pilots whom we had occasion to employ during the Civil War and, lately, in Cuban waters, have earned their title to respectful consideration for bravery under fire and for knowledge of affairs in their locality as well for readiness to impart that knowledge.

Lieutenant (now Lieutenant-Commander) Jas. H. Sears makes the pertinent suggestion that "pilots and persons available for

pilot work should be placed under surveillance." This should be the care of the Fleet Intelligence Officer.

Other Means of Obtaining and Transmitting Intelligence.

In military operations on shore, a captive balloon is sometimes used as a lookout station. That the range of vision is greatly increased by elevation, it is needless to state. A balloon might be employed to advantage by our naval signalers in certain localities. Indeed it has been suggested to fly one from a ship at sea. Personally, I fear that the disadvantages outweigh the advantages. It is possible to imagine, however, a driving in of our line of scouts, in the case of our standing on the defensive and in home waters, leaving the balloon as the only remaining resource. If sent up to a couple of thousand feet and in clear weather, with not too much wind, and connected with the ground by telephone, it would enable us to observe and report the enemy's approach at a great distance.

Wireless telegraphy is fast assuming the place of the carrier or homing pigeons once recommended for taking despatches to a point on shore from outlying vessels. The usefulness of this wonderful method of talking through space has passed beyond the point of speculation having been fully demonstrated on many occasions. I am strongly in favor of fostering such a service. It must not be forgotten that intelligence exists in three phases: First the seeing and ascertaining, second the reporting to the central bureau, third the transmission to the commander-in-chief. It appears not unlikely that wireless telegraphy will become so valuable as to displace all other methods of conveying information across water. To this reflection I shall have occasion to revert in speaking of scouts.

Organization.

We are now in a position to suggest the outline of an organization for the Intelligence Staff.

First is the Fleet Intelligence Officer on board the flagship and his immediate assistants—one or two junior officers and a writer.

Second, especially in case of a defensive war, his principal

assistant in some great commercial centre with aids and a sufficient clerical force. This assistant should have an office directly connected with the great telegraph and telephone systems of the country. He should have independent lines to the secondary base, if the war is to be carried on in home waters. To him would be sent all reports and despatches coming over wire for condensation and collation and for transmission to the flagship.

Third, an officer especially charged with the establishment, equipping, maintenance, and inspection of the coast signal stations. In certain cases he would require subordinate officers, one over each of the districts into which the entire system might be divided. The experience gained in the Spanish American War under this head will be invaluable.

The Chief of the Office of Naval Intelligence should be ordered to correspond directly with the Fleet Intelligence Officer or his principal assistants and to answer promptly all questions addressed to him by either of them.

The distribution of scouts, that is to say, their cruising orders should emanate from the Fleet Intelligence Officer and be signed by him, with or without the Admiral's countersign as the latter should determine. Personally I incline strongly to the belief that the admiral should be spared any and every detail which can properly be turned over to a subordinate. Nothing so tends to produce successful results as grave responsibility accompanied by adequate power. Given these, it is the man's own fault if he fails to meet the demands made upon him.

The Fleet Intelligence Officer will furthermore prepare and modify from time to time forms of reports from cruising vessels and instructions touching upon the particular kind of information he desires. It will be his duty to see that every possible aid in the shape of photographs, plans, and descriptions of the enemy's ships, both regular and auxiliary, are in the hands of the captain of every cruising vessel of our fleet. Doubtless many useful notions will occur to him and his subordinates which have escaped my attention. He must be governed by his sense of the great responsibility resting upon him and in no case can he expect to be pardoned if he fails to secure and place before the commander-in-chief information essential to the latter's needs and schemes. This is no light task, but upon the execution, however difficult, depends the right strategic and tactical

employment of our too scanty naval resources. I can not better close this brief and imperfect presentation of the subject than to paraphrase the saying of the present Chief of the Bureau of Equipment and contend that "The way to have enough information is to have too much."

(*To be continued.*)

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U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

THE PROBLEM OF ENGINEERS.

By LIEUTENANT URBAN T. HOLMES, U. S. Navy.

It has now been four years since the enactment of what has come to be known as the Personnel Law. Opinion seems to be agreed that all features of this law have worked for the good of the navy excepting the single one of amalgamation of the line and engineer corps. This feature has from the beginning caused much anxiety to the friends of the measure and at this time opinion is divided as to whether results have proven it to have been of benefit to the service. In the belief that free discussion is necessary to a proper understanding of the merits of this question, the writer presents the following views, from the standpoint of a line officer who was formerly of the engineer corps.

ORIGIN OF PERSONNEL BILL.

The personnel bill was an "omnibus" bill. For many years each element in the navy had been working to secure the passage of legislation that would operate for its own particular benefit and because in so doing the interests of the other elements were ignored, or were adversely affected, none of these measures could succeed in passing. Finally, through the successive failures of different factions in their efforts to secure special legislation, it came to be understood that no measure could pass on which the whole Navy did not agree. The result, after much effort to unite on common ground, was the "Personnel Bill." This measure practically gave to every branch of the service except the engineers what it had been distinctively asking for. To the engineers it gave the amalgamation feature, with such other benefits as were obtained by the line.

Benefits Sought by Engineer Corps.

The principal objects sought by the engineers had been, in the order of their importance: (1) An increase of numbers. (2) Relief from the position in which they had been thrust by the interpretation put upon that provision of the law which prohibited staff officers exercising military command. This provision, intended to prevent such officers being placed in command of a ship or shore station, had been construed to mean that no staff officer had authority to give a "military" order. The engineers contended that on board a naval vessel every order given by an officer on duty is as much a military order as any other, and that inasmuch as the engineer's force comprised a large proportion of the crew of each vessel, this placed them in an absurd position. (3) An enlargement of the scope of their duties to include the design, care, and management of all the machinery on board ship, instead of limiting their duties to those connected with propelling machinery alone. (4) Positive rank, the same as given the staff corps of the army.

The personnel bill proposed to accomplish the first object by making all line officers engineers. The second and fourth were accomplished by the amalgamation feature. The third object was not met in so far as the design and installation of all machinery was concerned, but its care and management was placed in the hands of the new line.

The amalgamation feature was the proposition of the old line of the navy and it may be said that it took the engineer corps by surprise. The first idea was to oppose it; but, after the scheme had been considered in all its bearings, its support was decided upon, this being apparently the only means of securing the objects sought, with the support and assistance of the line.

Effect of Personnel Law on Engineering Problem.

After the law has been four years in operation it appears that all the objects sought by the engineers have been accomplished, with the single exception of an increased number of officers for engineering duty. As to the effect of the measure in this particular, the different opinions that are expressed depend upon the point of view from which formed. On the one hand the fact is cited that all line officers below the rank of commander are available for engineer duty and many of them who are not former en-

gineers are performing such duty. On the other hand are the facts cited below which lend to the conclusion by the writer that the condition is so very far from satisfactory that we are perilously near an engineering crisis.

On January 1, the Navy Register showed 76 officers of the old engineer corps carried on the active list of the navy for engineer duty only. Of this number 17, having passed above the grade of lieutenant-commander, were not available for sea duty. Of the remaining number 33 were on sea duty, including 2 on shore duty in the Philippines, 25 were on shore duty, and 1 was returning from sea duty. The remainder of the former engineer corps are now line officers who, having given most of their undivided attention to engineering duties in the past, must, in order to acquire the experience necessary for duty as line officers, now give the greater part of their time to purely line duties. The number of officers available for important engineering shore duty has become so reduced that the officers who are performing such duty have had their work so greatly increased that it is practically impossible for these duties to be carried on efficiently. The most serious part of this phase of the situation however is the fact that the reduction in the number of such officers is steadily going on and that there is a wholly insufficient number of young officers of the line being trained as assistants to these officers in order to enable them to succeed to these duties.

Inexperienced Officers doing Responsible Engineer Duty.

The scarcity of officers of the old engineer corps is such that the time has been practically reached when they cannot be spared for sea duty, except on battleships and first-class cruisers. At the present time the machinery of almost all of our smaller vessels is in the hands of officers of the old line who have been assigned to duty as engineers in charge, with practically no previous engineering experience. The writer has often heard the statement made that "there is nothing mysterious about the engineering department of a vessel" and that the only qualifications necessary to add to a Naval Academy training in order to make a good practical engineer are common sense and experience. The fact that many of our young line officers have done fairly well in charge of machinery, with so little experience back of them, is perhaps due to their being

particularly well equipped with the first qualification. The apparent success has not in all of these cases however been due to the unaided efforts of the officer nominally in charge. Officers placed in this position are gaining valuable experience, but is not this a very hazardous way to give it to them?

The writer does not believe that the advocates of the passage of the personnel bill, prior to its passage, ever contemplated the practice of assigning officers to duty in charge of machinery without previous experience. It is hard to believe that any one with knowledge of the subject can contend that such a practice will not be destructive of engineering efficiency. At the time the bill was being discussed, prior to its passage, it was generally understood by the members of the engineer corps that the time of the junior officers (lieutenants junior grade and ensigns) was to be equally divided between deck and engine room duties. The understanding also was that they would be assigned to duty on shore as assistants to inspectors of machinery and in navy yards, where it is well known that an engineer gets his most valuable experience. These expectations have certainly not been realized. Where officers have been assigned to duty as assistants in the engineer department at sea it has been for short periods only and there has been no systematic, continuous method adopted for giving all young officers an engineering training. Nor has any effort been made to determine the fitness of an officer before assigning him to duty in charge of the machinery of a vessel. Practically no officers of the old line have been detailed for engineering duty on shore.

The law required the younger engineers to pass an examination on the duties of the line within two years after its passage, but required no examination in engineer duties from the line officers. This inconsistency was freely commented on prior to the passage of the act, the reply to all criticisms being that such details could be worked out by the administrative officers of the Department, that no officer would be assigned to important engineering work who was not properly qualified, and if the bill were hampered with too many provisions it would not pass.

Line Training Required of Ex-Engineers.

In carrying out the requirements of the law, the engineers were required to pass the intervening two years, prior to the ex-

amination, in watch duty on deck at sea. A general order from the Navy Department expressly prohibited such officers being assigned to duty as executive or navigating officers prior to their passing the prescribed examination; but, experience as watch officer in the engine-room, which is even more necessary in the making of a chief engineer, was not, and is not now, required of line officers assigned to duty in charge of machinery.

Suggestions Regarding Engineering Training.

The writer believed in the practical possibilities of the personnel law, at the time of its passage, and believes in them now, provided the law is administered as its engineer advocates were led to believe it would be. The young officer, prior to promotion to lieutenant, should spend half of his sea duty in subordinate engine room duty, and should also be assigned for a portion of the time to subordinate engineering duty on shore. Engineer officers in charge of machinery must be picked from officers showing aptitude for such work. If simple administrative rules such as these cannot be formulated and carried out, the personnel law cannot be made to supply officers properly qualified for engineer duty, and to that extent it is a failure.

If we could put these rules in operation we would, without detracting from their efficiency as deck officers, produce officers qualified as good practical sea-going engineers, for all except our largest vessels. They would not have the scientific training necessary to enable them to take up the work of designing or constructing machinery, or to enable them to act efficiently as fleet engineers, or chief engineers of our more powerful ships, where a higher order of engineering ability is required. Such officers would, however, have an excellent ground-work to build on in case they should desire to make engineering their life-work.

Practical and Designing Engineers.

A practical engineering training, such as would thus be given all officers, is not only contemplated by the personnel law, but is particularly desirable in the making of an efficient commanding officer for a modern vessel. The writer believes that, having acquired so much of an all around training, it will be best for an officer, beyond this point, to apply himself exclusively to either

military or engineering duties. The field is too large for any man, unless gifted with extraordinary genius, to become master of all the sciences required in the practice of the line officer's profession and to be in addition a highly skilled naval engineer. After reaching say the rank of lieutenant commander, officers should be permitted to choose between the purely military duties and engineering duties. If a small portion of the whole number of officers reaching this grade, possessing a natural inclination for engineering work, volunteered for these duties, the number would be sufficient to provide the highly skilled engineering talent required. The practical training received by these officers, supplemented by the post-graduate course in engineering studies at the engineering school, soon to be established, together with the experience gained by constant application to engineering work, would enable these officers to qualify for all the duties of the designing engineer.

To induce officers to relinquish the hope of ever commanding a ship or fleet and permanently take up engineering duty, as is here suggested, it would be necessary to present to them certain other advantages. These might well take the form of increased pay on sea duty and permanent employment on shore duty after reaching command rank. The increased pay on sea duty could be given as an additional allowance per indicated horsepower to the officer in charge of machinery at sea, with the old rate of pay to fleet engineers. The commissions of these officers in the line should be retained.

Necessity for Engineers.

These ideas are presented in the belief that the navy's most pressing need in the near future is going to be *Engineers*. First, there must be practical engineers to operate and care for our machinery afloat. Second, there must be men, with a scientific engineering training, for the higher work of the designing engineer. We must get these engineers somehow. The law, as at present administered, will not provide them and, as the members of the old engineer corps are rapidly going off the active list, *something must be done* to replace them. The method outlined above, if put into operation, would provide them.

If this method cannot be adopted and carried out some other scheme must be. One great argument in favor of this method

is that it gives the line officer that intimate acquaintance with engineering matters which is essential to the proper performance of his duties. No commanding officer can know his ship in the engineer department through inspections alone, unless he is a practical engineer, who has gained a working knowledge of the details through experience. The personnel bill contemplated the giving to line officers of this knowledge. To give up the plan will be a deplorable retrogression.

If we are not to get engineers in this manner, how are we to get them? Is it through the warrant machinists? The writer believes in commissioning such of these men as are individually found worthy, but any move to commission them all, or any relaxation in the standard that would result in commissioning a large number of them, would only result in spoiling good warrant officers to make bad engineers of them, and would renew the old fight that began just after the Civil War. These men are needed as warrant officers and, unless they can qualify for commissions under a high standard, they and the navy are better off to have them retained as such.

Designing Engineers must have Practical Training.

In considering the question of engineers it must be borne in mind that our designing engineers must be developed from our practical engineers. If not, the result eventually must be the placing of the design of our machinery in the hands of the naval constructors, or else with civilian marine engineers. Neither of these propositions should be even given consideration. The first, because no man, no matter how able he may be, is competent to design marine machinery unless he is a practical sea-going engineer. The second, because so much is required in the design of a man-of-war's machinery, that is not required in that of a merchant vessel, that the designer must have a thorough naval training to fit him for his work.

Whatever method may be adopted for giving us naval engineers, it must be one that will enable us to take them as young men, and train them in the service. There are so many advantages offered by the plan, outlined above, of taking them from among our young line officers, that the writer believes this plan must and will be adopted. If not, the method is suggested of commissioning additional officers in the lower grades for en-

gineer duty only. There are a number of technical institutions in the country which turn out excellent material for such officers and there would be no difficulty in obtaining from these institutions all the assistant engineers that may be needed. The present system of carrying officers on the list of the line for engineer duty only has worked so well that it is believed, if it were found necessary to appoint such officers, it would be better to give them line commissions than to form another engineer corps, with the attendant bickering and jealousy that existed when we had the old one.

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U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

PROPOSED ARMAMENT FOR TYPE BATTLESHIP OF U. S. NAVY, WITH SOME SUGGESTIONS RELATIVE TO ARMOR PROTECTION.

By LIEUTENANT HOMER C. POUNDSTONE, U. S. Navy.

"A"—GENERAL CONSIDERATIONS.

(1) In a former paper, the writer endeavored to indicate his admiration for and confidence in the splendid new type of battleships represented by the Louisiana class of vessels; and he would not advocate our ever building units for the fighting line of any smaller size than the Louisiana and Connecticut, but, on the contrary, he favors a type of considerably greater displacement than those ships. It would seem, when we start out to secure a powerful type of fighting ship, that we should go to the "bitter end" of the limiting conditions in each and every vital particular and then effect the highest, most efficient and powerful combination, balance and compromise amongst the several elements which enter the problem. Assuredly we must pursue some such course before we may, with satisfaction and pride, point to the result as being not only the best that we should do, but the very best we can possibly do at the present stage of the naval development of the world.

(2) With us, the question of cost—money—need not enter the calculation strongly, that is, if the country really means to effectively prepare to look out for itself under any and all circumstances. There is convincing testimony to the general interest, unanimity of feeling and intensity of purpose manifested by all classes throughout our country relative to the efficiency and preparedness for war of the navy, and there can be no doubt that the trend of public opinion in the United States is distinctly towards

a substantial increase of the naval establishment, as vital to our peace and continued prosperity. It is only necessary to cite the action of a number of our state legislatures in passing resolutions to that effect, and the formation of "The Navy League of the United States" for the purpose of disseminating accurate information as to the absolutely imperative needs of the navy, the purposes for which it is maintained and its full value as an economical, effective and certain protection for our commerce and for our citizens abroad and of defense for our coasts and outlying possessions. The almost universal utterances of the press of the country have voiced a demand for a good navy and one big enough for all needs. That the Congress is disposed to give faithful, practical and prompt expression to the will of the people in this regard is forcibly evidenced by the provisions of the last naval appropriation bill as to matériel and personnel.

All these facts—taken together—plainly indicate the insistent determination of the country to have an effective navy regardless of the cost, and to demand and secure an amply sufficient allotment of the public funds to meet all the requirements of this most important branch of the public service.

These indisputable facts would, further, seem to constitute the promise of a flat and emphatic contradiction to the late utterance of a distinguished foreign political-economist to the effect that a certain vital policy of our government, "Is an empty pretension behind which is neither energetic will nor actual power."

Should a resolution of the lower house of the late Congress, looking toward the adoption of a logical, rational and economical building, maintenance and supply program, ever become law and have the effect of leaving the types of ships, the numbers in classes and all other collateral technical requirements to be determined by the Department of the Navy, we may have the kind of ships we most need and in sufficient numbers to insure respect and to assure the integrity of the national policies and the inviolability of the national domain.

(3) The writer confidently expects to see, in the not very distant future, battleships of nearly if not quite 20,000 tons displacement; and the only absolutely final limitation to the power of fighting vessels is, in reality, the size at which they tend to become slow, unwieldy, practically impregnable floating fortresses instead of highly mobile, well protected offensive units for a fight-

ing line. We are, without any doubt, simply going to be forced to a displacement of as much as 20,000 tons, perhaps even a greater one, if we intend to make our battleships commensurately as strong defensively as they are now powerful offensively, and also maintain a ratio as high as the present one between motive power and displacement, and, in addition, carry fuel at all adequate to a satisfactory radius of action. It must be remembered, too, that we cannot postpone indefinitely the adoption of some certain means of lessening the liability to serious damage or total destruction resulting from the practically demonstrated efficiency of the "submarine" and "submersible."

(4) As to the possible size, then, for any standard battle unit, the limiting conditions are length, beam, draft, consequent displacement and the ability to carry sufficient motive power and fuel to assure to the vessel such considerable rate of speed and radius of action as tactical and strategic demands make imperative. In addition, to be truly formidable in offense and defense, the ship must mount a really powerful battery, to which same, together with the ammunition supply and the personnel at both we should afford all practicable protection; and the hull buoyancy and vital parts of the ship demand and must have reasonably adequate armored defence.

(5) So, while we might have just as large and formidable a vessel as we could possibly wish, there are practical limits beyond which we can not go in certain directions. For instance, the length is limited by considerations affecting structural strength and by the absolute necessity to assure handiness; the draft by the depth of water to our principal harbors and over the sills of our largest docks; and the beam, first by the requirements relative to the best form of hull for speed and handiness and after that by the necessity to produce a steady gun-platform and one not too wide for easily safe entrance into our largest docks, built or contemplated. Lastly, the element of speed is one having rigid and exact limitations for any given displacement; so that, in the end, we may only have as big a ship as we can get into our harbors and docks, move with such high speed as we discover to be most essential, and, finally, one which can be steered, turned and manœuvred with certainty and facility; and such a vessel, possessing also the greatest permissible offensive ability and protection, is, then, the acme of our possibilities.

(6) So, having ascertained the practical conditions which govern the final determination of the highest possible type of battleship, let us see how far we are advanced toward a realization of such an ideal type of vessel. Of course, if the units of the Louisiana class represent the sum total of what is feasible in the way of a battleship, then we should unhesitatingly adopt that type and should closely follow it, as a pattern, in adding to our fighting line, in order to secure, as nearly as possible, entire homogeneity in our battle units, the necessity for which is too very apparent to the entire naval profession to demand anything more than insistent mention If, on the other hand, we may have a type superior to the vessels of the Louisiana class, without unduly increasing the size and consequent displacement, it is clearly our duty to secure that greater effectiveness to our standard battle unit; for, when the necessity arises, and it may be sooner than we apprehend, to fight the battleships we must now build according to whatever standard we finally select, there is no thinking man who will disagree with the conclusion that such occasion will be the time when, "The best is none too good."

(7) In the writer's opinion, the armament of the Louisiana class, assuming the type represented by that class as the basis on which to work out our problem, may be very considerably improved and the protection be better distributed and materially strengthened without running the displacement up beyond a reasonable and practicable limit or sensibly decreasing the speed. Such moderate and relatively small increase of total displacement as may be necessary to achieve the results mentioned should be provided for by adding sufficiently to the beam of Louisiana class (see characteristics of King Edward class, where beam is 78 feet) without substantially affecting the already deep draft. It is not thought probable that we shall need much more weight for motive power than is assigned to Louisiana class of vessels to assure a trial speed of 18 knots, whichever method or combination of methods we may adopt to secure necessary flotation for the increased armament and protection weights.

"B"—Omission of Underwater Torpedo Installation.

(8) To the writer's mind, the conviction is superlatively strong that the omission of underwater torpedo discharge apparatus from our latest armored construction is a most inexplicable and mis-

taken policy, in fact that it is little short of fatuous. While perfectly aware that this characterization is robust, the occasion seems to demand it and derogatory reflections are distinctly not intended; for there must have been determining influences of the greatest possible moment and importance to have forced a conclusion so opposed to prudence and efficiency and to the present almost universal practice of the great naval powers. Especially is this fact deplored and deplorable at a time when submerged torpedo discharge apparatus has reached a high state of development as to safety, certainty and efficiency, and when the disadvantages of the fixed tubes have been practically overcome by the adjustable, wide-angle gyroscopic steering gear for torpedoes, and when a new torpedo of high speed and greatly increased range is virtually an assured success.

(9) Our possible and probable enemies all hold to underwater torpedo installation as an offensive and defensive auxiliary, and it would seem—to be even reasonably on the safe side—that we must not only come back to underwater torpedo discharge for future large armored vessels, but that we should if at all possible yet include this important feature in the designs for the construction of the four big armored ships just being laid down. Even should it involve the sacrifice of some less essential features of design, it is held that the battleships of the Virginia class and the armored cruisers of the Pennsylvania class, all of which are still under construction, should also be fitted with underwater discharge for torpedoes, at least with one submerged torpedo tube on each beam.

(10) This omission is, in the writer's humble opinion, simply an invitation to an enemy of even approximately the same speed, gun power and protection as our latest battleships and battle cruisers to come within possible torpedo range (and possible torpedo range is now from 1500 to 3000 yards or more) to deliver his heaviest and most effective gun fire; and there is no shadow of doubt that he would then hold our ship (which must depend upon her battery alone) at his mercy by being able to let off his torpedoes at will, with strong probabilities in his favor of effecting the complete destruction of our vessel.

In case our gun fire should be temporarily or seriously impaired, or the steering gear become deranged, or if both should happen, certainly our antagonist would not hesitate to attempt ramming, nor would he, in such a case as we cite, be in the least

danger from taking a position well within effective torpedo range (say 1000 yards or less) and sinking us, at leisure, with his torpedoes.

(11) It is manifestly imperative then, unless we deliberately decide to assume avoidable risks, that we should have underwater discharge apparatus for torpedoes on all our big armored ships; and the writer would argue not only for a tube on each broadside but for a bow tube worked low down, under and well abaft the ram. The idea of the bow installation is to give an extra torpedo (assuming all our torpedoes to be fitted with wide-angle gyroscopes) for use on either beam as well as ahead, and this arrangement of 3 tubes is believed to possess decided advantages over 4 tubes where two are installed in each broadside. The space required for these three installations can be readily spared on all vessels of the size of the Virginia, Pennsylvania, Connecticut and Tennessee, and the weight element involved is comparatively inconsiderable and practically not over 70 tons for 3 torpedo units complete, which is almost a negligible percentage of total weights.

(12) England, France, Russia, Germany, Italy, Japan and Austria, and even several of the less powerful navies, are following a consistent policy of installing underwater torpedo discharge for their armored vessels, and there is not even a hint of any let-up in this regard. We can certainly not afford to be vulnerable in this one respect when we are deciding upon types otherwise so powerful, which same are to have—let us hope—many almost identical successors. We must be prepared to meet an enemy with his own choice of weapons, and we shall be powerless to do so unless this more than fatal omission as to underwater torpedo discharge is repaired and our type armored ships restored to common ground with their corresponding classes abroad.

"C"—Objections to Battery of Louisiana Class.

(13) As to battery alone, the writer fails utterly to realize the logic, necessity or practical use in carrying a mixed intermediate or auxiliary battery of pieces so nearly the same calibre (and necessarily in power) as the 7-inch and 8-inch guns intended for the Louisiana class; one calibre of which—the 7-inch—it is manifestly feared may just fail of getting through an enemy's intermediate belt and casemate armor at anything beyond close battle range, or say anything over 2500 yards; and the other of which—

the 8-inch—it is evidently the confident hope and belief will just succeed in getting through everywhere, except the main belt, at an average fighting distance, say 2000 to 4000 yards. The actual penetration into "Kruppized" armor of which these calibres are respectively capable, under most favorable conditions, indicates that the above hypothesis is correct and tenable. The writer confesses to common intelligence, but he must admit that he is quite unable to see either consistency or efficiency in this state of affairs.

(14) The contentions for the inclusion of the 8-inch gun as a part of the battery of the Louisiana class were, in some part at least, sentimental, and on account of the good work we were able to do with this calibre during the Spanish war. But we are never going to have another such one-sided affair as that war, and there won't be any sentiment in this or any other regard the next time we come to blows.

(15) The characteristic elements of the 8-inch gun do not predispose one to believe in it as a certain—always-to-be-depended-upon—cure for the inherent limitations of the 7-inch gun with which it is associated. It is, therefore, entirely reasonable to conclude that, if we must have, in our battleship's battery, a calibre intermediate between 7 inches and that of the heaviest guns, we are logically compelled to go to a calibre above 8 inches or one giving sufficient power and penetration to be positively useful at all conceivable battle ranges.

(16) On account of its relatively low power, the 6-inch gun, as a calibre to be mounted on battleships, has become a back number with us and is headed the same way abroad. We have undertaken to replace it with a 7-inch gun of 45 calibres length of bore; and, before we can even start to use the 7-inch gun, we apparently begin to doubt whether it will really do what we designed it for, namely, stand a fairly good chance of getting through an enemy's lighter armor at mean battle ranges, so we piece out the auxiliary battery by going to the next higher calibre —the 8-inch—for a supposedly reasonable insurance that we shall have something, outside of our heaviest main battery guns, that we believe may get through the armor in question, except, perhaps, at extreme fighting distances.

(17) In this connection, it is pertinent to note that the general tendency abroad is toward an increase in the thickness of the intermediate belt and all casemate armor, in some cases to as

much as nine inches; and, if this practice becomes general, which is more than likely, then the 8-inch gun is no longer to be depended upon at all times to do even the work for which it is apparently now proposed to carry it.

(18) As a possible solution to the problem involved in the anomalous conditions above noted, the writer suggests a plan for a new and improved battery for our type battleships; the adoption of which new battery it is not believed will involve any prohibitive augmentation of total weights to be carried, but will increase the power and general efficiency, of our standard type battle unit, by a large factor.

"D"—Proposed Battery for Type Battleship.

(19) The Chief of the Bureau of Ordnance tells us, in his last report, that we are soon to have a 50-cal. 6-inch gun with a probable muzzle velocity of 3400 to 3500 foot-seconds; and that the new 45-cal. 12-inch gun will likely show 2800 foot-seconds muzzle velocity. The Krupp heavy 50-cal. guns, model of 1901, of from 4-inch to 12-inch calibre have actually given muzzle velocities in excess of 3300 foot-seconds on the proving ground. So we may fairly assume that all of our calibres can and will develop higher muzzle velocities than we have considered probable or even possible; and we may, then, count upon correspondingly large increases in muzzle energy. It is to be particularly noted—the kind of powder and density of loading being equal—that the muzzle velocity is a function of the length of bore as well as of the size of powder chamber and increased weight of charge (see superiority of results with Krupp 50-cal. guns over our shorter guns).

(20) The writer's first suggestion, then, with reference to his proposed battery would be to make all of the 7-inch guns, intended for it, 50 calibres long in order to secure the highest results of which this calibre is capable. In the writer's estimation, the 50-cal. 7-inch gun will be as nearly the ideal gun as we could secure or as could be desired for the smaller of the two calibres which it seems we must have in the auxiliary battery of battleships; for, unless we can absolutely trust this improved 7-inch gun to do the trick every time and all the time by taking care of all the work except what necessarily comes only within the province of the heaviest guns, we need and must have another calibre of auxiliary gun to reinforce the heaviest guns for punching effect at the

longer ranges; and such gun must be really powerful and not only reasonably but entirely certain to get through all an enemy's armor, except his main belt, at all distances within which a fairly high degree of accuracy of fire is permissible and possible. If, now, we have understood and stated properly and correctly the determining factors of this particular question, then the 8-inch gun does not fulfil the governing conditions, and we should, by all means, go to a calibre higher than 8 inches and develop a 50-calibre 9-inch gun to install where we now intend to carry 8-inch guns on the Louisiana class of battleships.

(21) If the British records as to the performance of 9.2-inch guns mean anything, the 50-cal. 9-inch gun should be nearly or quite as easy to handle (especially in turrets) as our present 8-inch gun, and will give a rate of fire appreciably equal to that of the 8-inch and must, of course, show an immensely greater energy and penetration than the 8-inch. To the contention that we cannot afford the weight demanded by the substitution of a 9-inch gun for the 8-inch of the present program, and that we are introducing a new and untried calibre of gun, the writer begs to reply by referring to the subsequent further elucidation of his plan for a new and, it is believed, an improved armament for our type battleship.

(22) The idea for new armament, in full, is to substitute 50-cal. 11-inch guns for the heavier 12-inch guns now intended to be carried; to replace the 8-inch guns of present battery by 50-cal. 9-inch guns; to retain the 7-inch gun as one calibre of auxiliary battery but to make all such 7-inch guns 50 calibres long in the bore. The secondary battery—3-inch and minor calibres—to remain as in Louisiana class; and, finally, to install three (3) underwater torpedo discharge units, in which most important particular the armament of Louisiana class is entirely lacking. In contrast with the battery of the Louisiana class our proposed new armament will then appear as follows:

Battery of Louisiana Class.		Proposed Armament for Type Battleship	
No.	Calibre.	No.	Calibre.
4	45 cal. 12 in.	4	50 cal. 11 in.
8	40 cal. 8 in.	8	50 cal. 9 in.
12	45 cal. 7 in.	12	50 cal. 7 in.
20	50 cal. 3 in.	20	50 cal. 3 in.
Minor calibres as already determined.		Substantially the same as in Louisiana class.	
Underwater Torpedo Tubes		Underwater Torpedo Tubes	
None.		*Three.*	

NOTE.—The writer would infinitely prefer to employ the 4-inch gun as the principal calibre for secondary battery of our type battleship because of its vastly superior muzzle energy, range and penetration to that of the 3-inch gun. The penetration of the 4-inch gun is as much as 2 inches into Krupp armor at 4000 yards; and this gun, with an efficient shield (which its mount can carry), might be used throughout any action and would give a racking, smothering and destructive effect of the greatest value and importance at all ranges. Besides, the 4-inch gun has practically as high a rate of fire as the 3-inch, and its ammunition may be handled with equal facility, and its mount is quite as easy to manipulate, so that this gun becomes just as efficient for use against torpedo-boats and submarines as the 3-inch. A calibre equivalent to the 4-inch is coming into general use abroad as a secondary battery gun and we cannot afford to neglect such a fact. However, the weight necessary for the 4-inch gun and its mount and ammunition will likely prove a deterrent to its use, as suggested, until such time as the apparent prejudice against enormous displacements has been overcome by the logic of events. The actual total of weight necessary to permit us to substitute 4-inch guns for the 3-inch of the Louisiana class would be (as to guns, mounts and ammunition, complete) about 100 tons in excess of what we assign at present to 3-inch guns, mounts and ammunition, pre-supposing the ammunition allowance for the 4-inch guns to be the same as is now furnished to the 3-inch guns of that class; and although the writer does not insist upon carrying 4-inch guns for principal calibre of secondary battery, their employment for that purpose is strongly recommended.

If the plan for new armament, as outlined above, be possible as to weight, it is eminently practical and logical and would give us a most powerful type ship with absolutely no superior to date.

(23) The general idea of the proposed battery has abundant and convincing support from latest intended practice abroad. Germany's most recent battelships are to mount 11-inch and 7-inch guns; Italy's last battle type is to carry 12-inch and 8-inch calibres, while the battery of King Edward class, of British Navy, includes 12-inch, 9.2-inch and 6-inch guns. Here we see three of the principal foreign navies assigning increasingly powerful calibres to the auxiliary (intermediate) batteries of their latest battle units. In this connection, it is interesting to remark upon the apparently final determination of the British Admiralty to substitute 7.5-inch guns for the 6-inch now assigned to intermediate battery of the Queen class; and, if this be done, it is more than likely that the King Edward class may have some or all of the 6-inch guns replaced by 7.5-inch pieces. So, if we intend to maintain our pre-eminence and make a serious endeavor to retain the proud distinction of mounting more powerful batteries on our

vessels—class for class—than any nation in the world, the armament suggested by the writer is not unreasonably heavy, especially when its overwhelming superiority to anything now mounted, or in announced contemplation to be mounted, is given due weight and consideration.

"E"—Arguments in Favor of Proposed Battery.

(24) The writer has long inclined towards the belief that a 10-inch gun was nearly, if not quite, powerful enough for the heaviest piece of ordnance to be mounted afloat. That a 50-cal. 11-inch gun would assuredly be amply powerful for any and all strictly naval uses, there is not even a shadow of doubt in the writer's mind. Such an opinion receives decided encouragement from the fact that one of the ablest and most progressive naval powers of the world has definitively settled upon the 11-inch gun for its heaviest weapon, the same power having, until a comparatively recent date, held that a 9.45-inch gun was sufficiently heavy and powerful for the hardest work that could be demanded of a naval gun.

(25) We have, since we commenced rebuilding and rearming our navy, made one drop in the calibre of our heaviest guns (from 13-inch to 12-inch), and the writer is persuaded that we should, in the interest of final total power and efficiency, make still another drop and go to the 50-cal. 11-inch, instead of the 45-cal. 12-inch, for our heaviest gun. The 12-inch gun is undoubtedly powerful and is believed to be unnecessarily so when weight is taken into the consideration, and it does not appear rational, useful or economical to carry the extra weight its complete installation entails if we may have all the power we shall ever need, under any circumstances, from an 11-inch gun.

(26) The Elswick Company has made 10-inch and 12-inch guns of 50 calibres length and the Krupps are prepared to furnish 50-cal. 11.02-inch and 12.01-inch guns to order, pieces of these calibres and lengths of bore having been already manufactured and tested. What has been accomplished abroad we can do as well, and with a 50-cal. 11-inch gun, giving anywhere from 2800 to a possible 3300 or 3400 foot-seconds muzzle velocity to a projectile as heavy as that for the Krupp 11.02-inch gun (i. e. 760 lbs.), who could pretend to say that we have not a piece of ordnance that will meet every possible call for high gun-power

afloat? The Krupp 50-cal. 11.02-inch, heavy, model of 1901, shows a muzzle energy and penetration decidedly superior to not only the Elswick and Vickers-Maxim 40-cal. 12-inch guns but to the Elswick 45-cal. 12-inch which is approximately the equal of our own 45-cal. 12-inch, the most powerful gun we have ever had it in contemplation to mount on shipboard. From these facts, it is plainly seen that we may have every confidence in the power of a 50-cal. 11-inch gun, and the adoption of that gun as our heaviest unit of naval ordnance and its substitution for the 12-inch on all our future battleships is accordingly most earnestly recommended and urged.

(27) Of course the adoption of the 11-inch gun introduces still another type of gun into the service, with its differing mount, ammunition, etc., and objection may be made on the score that we are unncessarily multiplying calibres if on no other ground. In answer to a possible objection of this character, the writer would advocate the entire abandonment of the 13-inch and 12-inch calibres for use afloat and the complete supersession of these two calibres by the proposed 50-calibre 11-inch gun; and he would manufacture no more of either of the larger calibres except such as are actually assigned to vessels building or contracted for and whose plans it may be impossible to so change as to accommodate the improved armament herein suggested; in this way the change would be gradually brought about without any great revolution in either methods or expenditures.

(28) To design and manufacture type 50-cal. 11-inch. and 9-inch guns and mounts and "try them out" for power, rates of fire, endurance and all collateral requirements, would be worth all the time and money it would cost, even if, in the end, they did not prove acceptable for the use herein proposed. It is, however, entirely reasonable to expect that they would show final elements equal or superior to the corresponding calibres of same length of bore, manufactured abroad; and, without any discussion, it is apparent that the proposed 50-cal. 11-inch gun and its mounting, ammunition, etc., will weigh less and cost less than the calibres we now have mounted to do the same kind of work. It is also safe to predicate, taking the well-known 9.2-inch English gun as an exemplar, that our proposed 50-cal. 9-inch gun may not be expected to cost a great deal more, in either weight or money, than the 8-inch gun it is suggested to replace by it on our type battleship.

(29) The writer would also favor the use of the proposed 50-cal. 9-inch gun, instead of the 40 cal. 10-inch on board vessels of the general characteristics of the Tennessee and Washington, since the 50-cal. 9-inch gun will be virtually quite as powerful as the 40-cal. 10-inch, and must weigh less and cost less as to the gun itself and its mounting and ammunition. The weight so saved may be devoted to protection, motive power or coal; and this suggested change in the armament of the big fast cruisers is bound to result in greater all-around efficiency whether we intend to use this class of ships for distant scouting or to reinforce the battle line or for both purposes; and whether we call them "armored cruiser scouts" or "battle cruisers," or adhere to the present simple designation, "armored cruisers."

(30) There certainly exists in principle, if not in practice, a condition which we may call ultra-conservatism for want of a better and closer definition. It is to be hoped that we may never find ourselves committed—in the development of the navy—to any course tending to produce such resulting condition.

(31) If we should find the 50-cal. 11-inch and 9-inch guns up to or in excess of the power to be expected of them, and finally deem it wise, prudent, practicable and economical to decide upon these two new calibres for use on our type battleship, the writer feels entirely certain that we will have made a definite approach toward the final solution of the problem of a type battery for our future battleships; and, even with the rapid strides being made in ordnance and armor, it seems most improbable that such a battery as the writer here proposes for our standard battle unit could demand radical alteration, as to its elements or in its entirety, within the lifetime of such ships as may carry it.

(32) It cannot, of course, be assumed that any armament which may be adopted as a present standard will always continue to be just the right and proper thing; for, the next big war may and very likely will give a lot of our theories, reasonable and practical as they now appear, the very rudest kind of shocks. However that may be, it does not seem possible that the armament herein proposed could fail at any time to prove really formidable.

(33) Let us see now, somewhat more in detail, how we shall gain by the adoption of the proposed battery. It is elected, in general support of the contention for the suggested battery, to undertake a comparison of the energies per minute from broad-

sides of the present battery of Louisiana class and the proposed battery, proceeding upon the assumption that battery arrangement is to remain substantially as in Louisiana class.

(34) As we have not yet developed either 9-inch or 11-inch guns, the writer has taken the 50-cal. 9.2-inch Elswick and the heavy 50-cal. 11.02-inch Krupp guns as fair exponents of proposed new calibres, so that the comparisons will show, relatively anyway, the value of the battery changes suggested. Also, as our own 45-cal. 12-inch gun is yet under manufacture and we have nothing more than theoretical data as to its elements, it has been considered sufficient to use, in this comparison, the elements of the Elswick 45-cal. 12-inch gun, as being a fairly close expression of the results which may be expected from our own 45-cal. 12-inch gun; the weight of projectile and muzzle velocity being practically the same for the two guns.

(35) There can be no doubt that the rates of fire of any 11-inch and 12-inch guns will be appreciably the same; though if there be any difference it must be in favor of the 11-inch gun, as its ammunition is lighter and the handling and loading appliances and the breech mechanism will be slightly easier of manipulation. The Elswick and Vickers-Maxim Companies claim a rate of fire of 2 rounds per minute for their 12-inch guns (and better records than this are shown for certain British and Japanese ships), but this could only be possible for short periods and even then only when the guns may be loaded at all angles of elevation and where the handling and loading arrangements are the perfection of mechanical design and functioning and the breech mechanism can be quickly and easily opened and closed. A higher sustained rate of fire may be secured when the principle is adopted of operating the breech block by the stored-up energy of recoil. Up to the present time, we have made no serious attempt, so far as can be ascertained, to increase the rate of fire of our heaviest guns by even providing means of loading them at all angles of elevation. But, if we expect and intend to "keep up with the procession," we must come to it; and we should, the writer thinks, make use also of the principle of operating breech mechanisms of our heaviest guns from force of recoil, and adapt same to all calibres above the 6-inch. With our present and immediately prospective 12-inch gun and mounting, we cannot possibly hope to do better than one round per minute, and that rate of fire is assumed for both

the 12-inch and 11-inch guns in making the subsequent comparisons. Any mechanical improvements in the means and methods of loading will give relatively the same results for these two calibres.

(36) Again, English makers claim rates of fire, for the 9.2-inch gun, of any where from 2 to 4 rounds per minute, and the British Admiralty figures for the 9.2-inch gun are 3½ rounds per minute. Allowing that we may get up to a sustained rate of fire of 2 rounds per minute with our 8-inch gun (1.2 rounds per minute is our Bureau of Ordnance figure for rate of fire of 8-inch gun, while the Elswick Company claims 4 rounds per minute and the Vickers-Maxim Company 6 rounds for 8-inch guns of their mounting), it is not considered unfair to assume a rate of 2 rounds per minute both for our 8-inch and the English 9.2-inch guns in making the following comparisons. Where no arrangements exist for all angle loading, and if hand loading must be depended upon, the 8-inch gun might do a shade better than the 9.2-inch; but, where all the operations of handling and loading are done by power, and where it is possible to load at any elevation, the 9.2-inch gun will give an equal rate of fire with any 8-inch gun if both are mounted in turrets.

(37) The comparisons, in detail, of the elements of the guns of present and proposed batteries will then be as follows:

TABLE I.

50 cal. 11.02 in.* Krupp, model 1901. (heavy).	45 cal. 12 in.* Elswick.
Wt. of gun.....44.6 tons.	58.5 tons.
Wt. of projectile .....760 lbs.	850 lbs.
Muzzle velocity.....2949-3330 f. s.	†2780 f. s.
Muzzle energy .....45888 ft. tons.	†43900 ft. tons.
Penetration at muzzle (Iron) ...50.2 in.	†46.7 in.
Rounds per min. .....1 (assumed)	1 (assumed)
Muzzle energy per min...45888 ft. tons.	†43900 ft. tons.

*These guns are actually built and tested and their elements are well established and fully tabulated.

†Our 45-cal. 12-inch. gun, as designed, will give considerably better results than these, but the force of the final comparison is not sensibly weakened because of such fact.

TABLE II.

40 cal. 8 in.‡ U. S. Navy.	50 cal. 9.2 in. Elswick.
Weight of gun.....18 tons.	28.4 tons.
Weight of projectile.....250 lbs.	380 lbs.
Muzzle velocity ... .2800 f. s.	2890 f. s.
Muzzle energy.....13602 ft. tons.	22000 ft. tons.
Rounds per min. .....(2 assumed)	2 (actual)
Energy per min.....27204 ft. tons.	44000 ft. tons.

(38) In broadsides, we shall have:

TABLE III.

For Louisiana class.		For vessel with proposed battery.	
No.	Calibre.	No.	Calibre.
4–	12 in. 45 cal.	4–	11 in. 50 cal.
4–	8 in. 40 cal.	4–	9 in. 50 cal.
6–	7 in. 45 cal.	6–	7 in. 50 cal.
10–	3 in. 50 cal.	10–	3 in. 50 cal.

Neglecting the 7-inch guns, for the moment, as common to both batteries, we shall have muzzle energies per minute from broadsides of the heaviest guns as follows:

TABLE IV.

Louisiana class.						For vessel with proposed battery.					
Cal.	No.		M. E. per min.		M. E.-B.	Cal.	No.		M. E. per min.		M. E.-B.
12 in.	4	×	43,900	=	175,600	11 in.	4	×	45,888	=	183,552
8 in.	4	×	27,204	=	108,816	9 in.	4	×	44,000	=	176,000
					284,416						359,552

From which it may be seen that the proposed battery will give, for its two heaviest calibres, in broadside, over 25 per cent more striking energy per minute than corresponding calibres of Louisiana class.

(39) The Elswick Co. and Vickers Sons and Maxim Co. both claim 20 rounds per minute for their 50-cal. 3-inch gun and 15

‡ Later information has it that the 8-inch guns for Louisiana class are to be of 45 calibres length to prevent blast and flame interference with casemate guns. If this be correct, all calibres (12-inch, 8-inch and 7-inch) of main and auxiliary battery will then be 45 calibres long in the bore. It would seem infinitely better to go at once to 50 calibre guns for everything we carry in main, auxiliary and secondary battery. There would be less liability of injurious and crippling effects from blast, flame and the backlash of the stifling powder gases, and we should get much more energy out of the respective calibres.

rounds per minute for the 50-cal. 4-inch, but it is believed that 7 and 5 (approximately in same ratio as above noted rates of fire) represent more nearly the sustained rates of fire of which these guns are respectively capable, and those rates are used in the following tables:

TABLE V.

	Muz. energy.	Rounds per min.	M. E. per min.
50 cal. 3 in.	875	7	6,125
50 cal. 4 in.	2,000	5	10,000

In broadsides we should have:

TABLE VI.

	No.	Muz. energy per min.	Energy of broadside.
For 3 in. guns	10	6125	61,250
For 4 in. guns	10	10,000	10,0000

So we see if we could make use of the 4-inch gun, and mount a number equal to the 3-inch of present battery, we should get from the 4-inch gun a broadside energy over 60 per cent in excess of what is possible to the 3-inch gun. It is believed that the ten 4-inch guns in a broadside would be substantially as valuable for racking, smothering and destructive effect as say five 6-inch and five 3-inch together, since no one of the three calibres can effect penetration beyond short ranges; and the 4-inch will do good work at practically as great distances as the 6-inch and at the longer ranges where the 3-inch has already become valueless.

(40) To get the grand totals of striking energy per broadside per minute, we shall have, in addition to the results shown in Table IV for the heaviest guns, six 7-inch guns in each of the broadsides. The Bureau of Ordnance figures for the 45-cal. 7-inch gun are: Muzzle energy, 9646 foot-tons; rate of fire, 2½ rounds per minute, and hence a muzzle energy per minute of 24,115 foot-tons. For the main and auxiliary (intermediate) batteries of each vessel, we shall have total muzzle energies per broadside per minute as follows:

TABLE VII.

Louisiana class.			For vessel with proposed battery.		
Cal. No.	M. E.	M. E. B.	Cal. No.	M. E.	M. E. B.
12 in. 4	× 43,900	175,600	11 in. 4	× 45,888	183,552
8 in. 4	× 27,204	108,816	9 in. 4	× 44,000	176,000
7 in. 6	× 24,115	144,690	7 in. 6	× 24,115	144,690
		429,106 Total M. E's per B. per min.			504,242

A comparison, then, of these total muzzle energies developed per broadside per minute not only proves that the proposed battery is virtually 18 per cent more powerful in broadside than that of Louisiana class, but a simple computation will show same to be equally true for ahead and astern fire and for the fire over small angles from the fore and aft line to bows and quarters.

(41) Further, an examination of Table VII with reference to muzzle energies per minute developed by each calibre in broadside will forcibly demonstrate how much superior the proposed battery is that of Louisiana class in the matter of the distribution of the total muzzle energy per broadside per minute amongst the various calibres.

(42) Suppose, for the purpose of emphasizing this feature of the comparison, that we tabulate, for each of the two batteries, the ratio of the energy developed in broadside by each calibre to the total battery energy per broadside per minute, when we shall have:

TABLE VIII.

For Louisiana class.			
Total energy per B. per min.	12 in.	8 in.	7 in.
429,106	175,600	108,816	144,690
Percentage, 100%	41%	25%	34%
For vessel with Proposed Battery.			
Total energy per B. per min.	11 in.	9 in.	7 in.
504,242	183,552	176,000	144,690*
Percentage, 100%	36%	35%	29*

(43) An inspection of Table VIII discloses the fact (to which particular attention is invited) that for the present battery of 12-inch, 8-inch and 7-inch guns the percentages of the total energy developed in broadside by the respective calibres are 41, 25 and 34, while in the proposed battery of 50-calibre 11-inch, 9-inch and 7-inch guns the corresponding values are respectively 36, 35 and 29, fully demonstrating the fact that in the proposed battery we have so distributed the total energy (itself very largely—18 per cent—in excess of that given by present battery) amongst the various constituent calibres that we may expect to get the greatest

* These figures will be *perceptibly* greater, actually and relatively, when the elements of the 50 cal. 7-in. gun are substituted for the values used, which are those for the 45 cal. 7-in. gun.

possible returns from its expenditure and with less probability of a dissipation of the fire energy for no show of practical work done. In other words, with the proposed battery each calibre (by its performance) gives complete justification for being included as a part of the battery.

(44) In illustration of this particular point, Table VIII shows that, in the present battery, we have concentrated much the largest part of the total energy of fire in the heaviest main battery guns, the 12-inch, where it is least available by reason of their necessarily slow rate of fire. The writer's conception of the rôle which the heaviest guns ought to play is that they should provide us with the means of opening the fight at extreme ranges, and, while necessarily employed throughout any and all actions with big ships, assure us of being able to give the "*coup de grâce*" when penetration is effected. For such purposes the writer is not an advocate of assigning to the heaviest guns the great preponderance of the total battle energy of which our vessel is capable, especially when such procedure takes away (subtracts) from more mobile energy with which we might be able, between fires of the heaviest guns, to effect the partial or entire disablement of an adversary.

(45) We see also, from Table VIII, that the 8-inch guns develop even a smaller percentage of the total energy than we get from the 7-inch guns (9 per cent less) and nothing to approach that given by the 12-inch guns; so that, for these reasons and because of their doubtful ability to get through an enemy's lighter armor at normal ranges, the 8-inch guns do not appear (as now arranged and mounted for the Louisiana class) to satisfactorily account for their existence as components of the armament of our battleships.

(46) On the other hand, we see from Table VIII that while we get from the proposed battery practically 18 per cent more total energy per broadside per minute than from the present battery, we have, in addition, so disposed amongst the various calibres the total work, of which our new battery is capable, as to obviate the necessity of depending upon any particular calibre to give an unduly high relative proportion of the total fire energy; for we have, by our selection of calibres, been enabled to avoid the allotment of such a large fraction of the total energy to the heaviest guns, the 11-inch, as we see, by again referring to Table VIII, that the 11-inch guns give relatively but very little more (only one per cent) of the total energy than we are able to get from the 9-inch guns of our proposed new battery.

(47) The tremendous factor of the total energy developed by the 9-inch guns accentuates, still more forcibly, the inferiority of the 8-inch guns as mounted in the present battery; and it must be remembered also that the large energy per minute of the 9-inch gun is due not alone to its high muzzle energy but to its comparatively high rate of fire; and the very causes which operate to produce its big energy per minute, viz., facility and rapidity of loading and comparative ease and speed of manipulation to aim and fire, render the use of this calibre the more available and valuable, as an auxiliary to the 11-inch guns, for breaking down all except the very heaviest of an enemy's protection. As already stated, the ability of the 8-inch gun to achieve such results is seriously doubted and is certainly impossible if we must engage and fight it out at long range. The development of a 50-calibre 9-inch gun appears, therefore, to be imperatively demanded; and said gun is very evidently its own best argument, furnishing, as it does, by the performance of which it is capable, the very strongest reasons in favor of its adoption for use in the battery of our type battleship.

(48) Again, it is entirely obvious that the 50-calibre 7-inch gun, proposed for new battery, will give a materially higher muzzle energy than the 45-calibre 7-inch gun; and, as it will undoubtedly be practicable to get an equally high rate of fire from it as from the 45-calibre gun, we shall secure from this calibre a muzzle energy per minute which will be of vital assistance to the heavier guns in destroying the more lightly protected and unarmored parts of an enemy's hull and in producing a smothering and racking effect of the highest importance, desiderata of no mean value in deciding a naval conflict. The Elswick Company claims a rate of 5 rounds per minute for their 7.5-inch gun and the Vickers-Maxim Company claims 8 rounds per minute for the same calibre gun of their manufacture and mounting. While it is not believed that such high rates of fire can possibly be sustained by either the guns or their crews for even a short interval of time comparable to the length of an action, the writer thinks that it is perfectly practicable to get a normal rate of fire of say 3 rounds to the minute for our new 50-calibre 7-inch gun, but only by fitting it with a most reliable quick-action breech plug and adopting for it the most improved mechanical handling and loading devices. Such rates of fire as the English gunmakers

claim for the 7.5-inch gun are clearly out of the question when hand loading must be depended upon.

(49) The proposed change in battery certainly receives wonderfully strong support from the contrast we have made of battle energies per calibre per minute and of total battle energies of broadsides, and there appears every reason for the adoption of the new battery entire if it can possibly be carried and efficiently protected and its ammunition supply be kept at anything like an effective maximum. Take it as we may, the new battery gives every evidence of being reasonable, logical, practicable and feasible, and to be infinitely preferred to what is, apparently, now regarded as the highest attainable battery combination for our most powerful battleships; and the writer, in view of all that has been adduced in support of the battery he proposes, earnestly recommends the full, deliberate and careful consideration of said battery with a view to its adoption as the pattern battery for our standard type battleship. If this can be and is done, we shall have, in a vessel only slightly larger than the Louisiana and carrying the armament herein suggested, a tremendously powerful type of battleship that may be consistently followed for a long time in the increase of our naval establishment as to battle units.

"F"—Protection to Battery and Ammunition Supply.

(50) There can be no reasonable doubt that the general trend of opinion and practice in the principal navies of the world is toward greater displacement for battleships, more formidable armaments, the utmost practicable segregation of the battery units, and better, more widely extended protection for hull, gun emplacements and personnel. We must not be caught napping if we intend to be in the front rank as to naval power, efficiency and preparedness.

(51) The subject of armored protection for battleships is so intimately related to the question of armament that it is not deemed irrelevant to consider same here in connection with the definite suggestions brought forward for the improvement of the armament of our present type battleship. Accordingly, the writer does not hesitate to express his views as to the absolutely imperative necessity to efficiently protect the battery, ammunition supply and personnel, if we mean that our ship shall have a fair show in a finish fight; nor can the writer avoid indicating how he be-

lieves the armor scheme of the Louisiana class may be modified and improved to assure a more effective distribution of total protection with special reference to the integrity of the battery and ammunition supply and the safety of the personnel at them.

(52) No changes are contemplated that will affect in any way the armor scheme of the Louisiana class except as to the main belt, lower casemate armor and transverse armored bulkheads at ends of same and the protection to the 3-inch guns on main deck and those inside the superstructure.

(53) With the advances that have been made and are being made towards securing more resistant armor for an equal thickness, it has been concluded (and very wisely, the writer thinks) in the majority of foreign navies that 9 inches of K. C. or equivalent armor is a sufficient thickness for main belt in wake of motive power and magazines, especially since the increasingly formidable batteries to be carried are capable of holding an adversary at a respectful distance and thus lessening his chances of effecting penetration of main belt armor in wake of the vitals. Even should the main belt be penetrated, it is doubtful if the resulting damage could be more serious than the destruction and injury to life which would inevitably result from the penetration of intermediate belt armor, for the very good reason that we may expect the protective deck, bunker subdivision, close stowage, upper wings and cofferdams in wake of main belt to more completely localize the bursting effects of large shell, coming through there, than is possible in the more open berth deck space behind intermediate belt armor, where, also, there must be certain lines ("chains") of ammunition passers and other personnel; while in the spaces directly behind main belt there should not be a single individual above the protective deck unless coal is being handled there, and this should never be a necessity during an action; for, if at all possible, the upper bunkers should be filled and closed off whenever an engagement is imminent, and, in any case, the lower bunkers should be the only ones used from during an action. On this account and because of the fact that the best opinion and practice indicates that intermediate belt should rank next in thickness to main belt, it is proposed to make the lower casemate armor, and the transverse bulkheads at ends of same, 8 inches in thickness, inasmuch as this armor must not only help to assure protection to the vitals and, in a measure, to the casemate guns

as will be shown, but has the additional important duty of protecting the ammunition supply, failing which supply, a large part of our intermediate and secondary battery becomes worse than useless, in fact, only so much dead weight of metal, and the crews of such guns as can not get ammunition are reduced practically to supernumeraries and our offensive power is cut down by a very considerable and most vital factor.

(54) In support of the suggestion to increase the thickness of lower casemate armor to 8 inches, it is interesting to refer to the Belleisle experiments, which proved conclusively that the greatest damage to her was the result of the upward efforts of the explosion of large shells which had entered between decks. Suppose a large shell to have penetrated the intermediate belt of our present type battleship, its bursting effect would not only play havoc with the hoists of the ammunition supply and the people composing secondary battery "supply chains," but would, indubitably, put out of action the casemate gun or guns directly over and in the wake of its greatest explosive effort. Some of the later battleship designs abroad contemplate a flat armor deck at top of intermediate belt, apparently with an idea to serve as a sort of extra protective deck and to keep the space behind intermediate belt from being entered by "plunging fire," and to safeguard the casemate gun emplacements by localizing the bursting effects of large shell which may get through the intermediate belt into space underneath casemates. It would appear that the weight of such a flat armor deck might be better applied to an increase of the thickness of upper and lower casemate armor, making penetration of same that much more difficult or impossible; for, the experiments referred to do not lend color to the belief that the flat armor deck would or could effectually prevent the disablement of guns in the wake of greatest explosive effort of large shell, but, on the contrary, such flat armor would, more than likely, only powerfully assist to so contain the explosive force in the confined space between it and the berth deck as to produce infinitely more damage there and also more violent upward effect, to the certain detriment of casemate gun emplacements.

(55) In view of above noted facts, which appear incontrovertible, the writer recommends and advocates reducing the main belt of our Louisiana class to 9 inches, grading off to 7 inches, 5 inches, 4 inches, towards ends of ship, the 7-inch armor of main

belt commencing where said belt crosses (forward and aft) the transverse armor running down to protective deck. Next, to increase the thickness of intermediate belt (lower casemate) and its thwartship armor from 6 to 8 inches, the transverse armor at this height to carry on down to the protective deck at *full* thickness of 8 inches. The upper casemate and transverse armor at same height to remain 7 inches as now, but the protection to 3-inch guns on main deck and those inside of the superstructure to be 3 inches of nickel-steel instead of but two inches as now intended for Louisiana class, so that these guns of secondary battery may, when occasion demands, be used throughout an action without exposing their crew to certain annihilation. The advisability of this suggested increase in thickness of the armor over the 3-inch guns is open to question and is not strenuously insisted upon as are the other proposed changes in general scheme of protection.

"G"—The Question of Weights.

(56) Let us now examine into the question of our ability to carry the weight of proposed new armament and protection. Reference to Table I will show that we may save, in the drop from the 12-inch to an 11-inch gun, about 14 tons for each gun, or a total of 56 tons from the four heaviest guns of main battery. From Table II, we see that to substitute 9-inch guns for the 8-inch guns of present battery will demand 10.4 tons per gun, or a total of about 83 tons for four pairs or the eight principal guns of intermediate battery. So far, then, as the guns alone are concerned, we shall be forced, by the proposed change, to carry but 27 tons more weight.

(57) There are, however, a number of additional considerations to be taken into account. The 11-inch guns will not demand quite as heavy mounting as the 12-inch, nor need their barbettes and structures nor the turrets and their supports be so large, consequently not as heavy as those for the 12-inch guns. Again, the handling and loading appliances for the 11-inch guns may be made lighter than for the 12-inch, as the 11-inch ammunition is of fully 10 per cent less weight than that for 12-inch gun. It is, therefore, to be expected that we may effect a marked saving in weight by adopting the 11-inch gun.

(58) But, to carry eight 9-inch guns in four turrets, instead of present 8-inch, will involve a very considerable increase of

weights along the identical lines by which it was possible to save weight in the former instance; and, although the writer has no precise data on which to base exact calculations, a rough estimate indicates that these proposed changes in battery, viz., the substitution of 11-inch and 9-inch guns for 12-inch and 8-inch will involve an increase in total weights of about 114 tons for guns and ammunition and 72 tons for weight of larger barbettes, turrets, etc., and heavier mountings for 9-inch guns.

(59) It might be possible to save something in weight by adopting the barbette mounting, instead of turrets, for the pairs of 9-inch guns. This method of mounting pairs of heavy guns is being used very extensively abroad, especially in new vessels for the Royal Navy and in ships turned out for other powers by the Elswick and Vickers-Maxim Companies and certain German firms. Personally, the writer prefers turrets; but if it be absolute essential, on account of weight, to have the proposed 9-inch guns mounted barbette fashion or not carry them at all, then the writer would favor the comparatively less well protected barbette mounting, but only in that case.

(60) An article from the "London Engineer," quoted on pages 24 and 25 of "Notes on Naval Progress for 1902," refers to the feasibility of substituting 7.5-inch guns for the 6-inch of the Queen class, and is, in its terms and conclusions, peculiarly apposite to this entire consideration of the question of weights. The article need not be requoted here, but its perusal is recommended in connection with the writer's contention for the substitution of 9-inch guns for the present 8-inch of Louisiana class. Amongst other statements made, is one to the effect that 50 tons, more or less, may be regarded as a negligible weight in any of the 15,000-ton battleships designed by Sir William White, the margin in them being anywhere from 800 to 1000 tons, witness the difference in amount of coal carried at various times without sensibly affecting the speed. It is also shown how much unnecessary weight in excess stores and spare articles is carried, which might infinitely better be devoted either to battery and protection or to motive power and coal. Assuming similar conditions to obtain for our latest ships, and they manifestly will, we may get a very considerable weight to devote to armor and armament by scaling down to actual necessities the large quantities of stores, provisions, clothing and spare articles and gear of all kinds it is the

present practice to carry. It is also difficult to see just why a fighting ship should, under ordinary peace conditions, carry so much "stuff" of various kinds and descriptions that she must get rid of at the first "clear ship for action" on threatened outbreak of hostilities. It is maintained that the normal condition of service in our fighting vessels should approximate in every particular and to the utmost practicable degree the real status which will obtain when war has to be undertaken. There is too much white paint, brightwork and fallals and too little real effective preparation for battle. It is absurd to carry all the "dunnage" ordinarily to be found on our ships for use in keeping them looking like yachts when, instead, they ought to look and act the part for which they were designed and are maintained, more like prize fighters in the pink of condition and very much less like honorary colonels on a governor's staff at a review of state troops. If a list could be furnished of all the material that was landed at Key West or hove overboard from our vessels on the way to Cuba, at the outbreak of the Spanish War, a fair idea could be obtained of how impossible it would be to exaggerate in this matter.

(61) The question of ammunition allowances per gun per calibre will, in the writer's estimation, bear a careful overhauling and a possible revision with every prospect of a large gain in the general effectiveness of our battle units.

(62) If the rates of fire which the authoritative records and our own experience lead us to believe may be sustained throughout an engagement are even approximately correct, we are, without any doubt, carrying a considerable "dead weight" of ammunition for the heavier calibre guns of our intermediate battery. Let us assume as reasonably attainable the rates of fire shown in the following table and see how long our allowance per gun per calibre will last.

Calibre.	Rate of fire, rounds per minute.	Allowance per gun (rounds.)	Time to exhaust allowance (minutes.)	Number of rounds to the ton.
12 in.	1	Bu. Ord. 60	60	2
11 in.	1	Assumed. 60	60	2¼
9 in.	2	Assumed. 100	50	4½
8 in.	2	Bu. Ord. 100	50	6¾
7 in.	3	Bu. Ord. 100	33	10
4 in.	5	Assumed. 300	60	40
3 in.	7	Bu. Ord. 300	43	88

From this table it is apparent that the 12-inch guns may be fought for at least 60 minutes; the 8-inch guns for 50 minutes, and the 7-inch guns for only 33 minutes. The lighter guns (3-inch or 4-inch of secondary battery) may be neglected in this discussion, as their allowances of ammunition are dependent on other considerations from actual battle. Any decrease, from rates above noted, in the actual number of rounds per minute fired by the heavier (8-inch or 9-inch) guns of intermediate battery, or increase in the rate of fires of the 7-inch guns, will only more forcibly emphasize the writer's contention that we are, at present, carrying too many rounds per gun for the heavier calibre of auxiliary battery. As the 12-inch (or 11-inch) gun has to be prepared to fight for twice the interval (once on each broadside) for which any broadside gun must have ammunition, its present allowance, relatively to that of the 7-inch, seems to be about what will be required.

(63) But, when the tremendous weight of ammunition (see above table, "Number of rounds to the ton") for the heavier guns of the intermediate battery are taken into account, it does not appear either reasonable or necessary to make it possible to maintain an action nearly twice as long with the 8-inch (or 9-inch) guns as with that most important calibre—the 7-inch gun. Of course we could remedy the difficulty by giving the 7-inch guns a bigger allowance, but we should have to add 51 rounds per gun, or a total of 612 rounds, or 61 tons of weight to bring 7-inch allowance up to level with that for 8-inch (or 9-inch) guns. Such a course is clearly impracticable; and, as we stand at present, it appears inadvisable (to say the least) to carry an allowance of 8-inch ammunition to use long after that for the 7-inch gun is exhausted.

(64) By readjusting the allowances per gun to a harmonious correspondence with the normal rates of fire which each calibre is capable of sustaining, which will mean that we must reduce allowances of the heavier intermediate battery guns, we shall save (272 rounds) 41 tons on the 8-inch ammunition, which would go a long way towards giving us 4-inch guns in place of the present 3-inch guns. All magazines and shell rooms will unquestionably be filled at the outbreak of war and refilled at naval bases or from ammunition supply ships directly after each big engagement. It should, in time of peace, be the invariable practice to fill up with ammunition as soon as possible after each target practice, so there is no

absolutely unqualified necessity to carry an excess of ammunition for any big calibre on board.

(65) This seems to be a proper time and place to mention the writer's entire disagreement with our custom of carrying reduced charges; of course they are carried only for target practice and to spare the guns as much as possible, but they take up valuable magazine space and their use for any purpose is deprecated. The very essence of the training and preparation for war would appear to demand the constant use of all apparatus and appliances, designed for war, in the identical manner that said material must be employed during war, and this is as true for men as for machines; for men never use even the best of tools properly until the manner of such use has become fairly instinctive or almost a habit; even then, no variant elements must be allowed to enter and disturb the involuntary, customary actions of the human factor at our machines. The writer has been an eye-witness of two target practices, on successive days and under identical conditions of speed, weather, wind and sea, and after the crew of a first rate ship had been drilled for months at aiming and sub-calibre practice. The first target firing was a "record" practice with reduced charges and was an excellent performance with great guns; the second firing was a "battle efficiency" practice with full charges, and the crew simply could not and did not find the target with a calibre greater than a six pounder, which calibre has no reduced charges.

"H"—Necessary Increase of Displacement.

(66) Now let us see how we stand as to weights, comparably to the Louisiana class, and by how much we must increase the displacement of that class in order to get our suggested improvements in the armament and to the protection.

(a) The underwater torpedo installations—two (2) of which we simply must carry—will weigh, for three (3) units, about 70 tons.

(b) The final increase of turret weights involved by substituting 11-inch for 12-inch guns, and 9-inch guns for 8-inch will amount to about 72 tons.

(c) The increase in weight on account of new 11-inch and 9-inch guns and ammunition will only be, roughly, 114 tons.

(d) The weight necessary to make intermediate belt and its transverse armor 8 inches thick instead of 6 inches will be approximately 176 tons; and the additional weight for one more inch of nickel steel over six 3-inch gun positions on each broadside, i. e. 3 inches instead of 2 as now, will be about 30 tons, if this latter increase is held to be advantageous and warranted.

(e) As a partial offset to the increases noted, we may, by reducing the thickness of main belt armor from 11 to 9 inches, save about 129 tons in weight.

(67) As a final summing up on the subject of weights, we shall then have:

	Tons.
(a′) Increase on account of 3 underwater torpedo units	70
(b′) Turret weights on account of new battery	72
(c′) Excess weight of new guns and ammunition	114
(d′) Armor, 2 inches to intermediate belt and T. S. Armor	176
and one inch outside of twelve 3-inch gun positions	30
Total increase of weight for new armor and armament	462
(e′) Saving by a reduction of 2 inches on main belt	129
Final weight for which proper flotation must be provided	333

This amount of extra weight—333 tons—will require us to augment the displacement of Louisiana class by about 900 tons, as nearly as it is possible for the writer to figure it, which would make the trial displacement of our new type ship about 16,900 tons and her gross displacement something near 18,600 tons, which is only an increase of 5 per cent on the full-load displacement of Louisiana class, and but little over 500 tons greater displacement than will be shown by the King Edward class, the latest battleships under construction for the British navy. However, our suggested new type of battleship will have a broadside battery energy over 30 per cent in excess of that of King Edward class, assuming that the ten 50-calibre 6-inch guns of that class have a muzzle energy of 6075 foot-tons and can sustain a rate of fire of 4 rounds per minute.

(68) Our proposed new type battleship, compared with the Louisiana, will exhibit the following characteristic differences from the qualities possessed by that class of vessels:

	Louisiana.	New type battleship.
Beam,	76′ 10″	78′ plus.
Maximum draft,	26′ 9″	27′ plus.
Trial displacement,	16,000 tons.	About 16,900 tons.
Gross displacement,	17,700 tons.	About 18,600 tons.
Armament,	4 – 45 cal. 12 in. 8 – 40 cal. 8 in. 12 – 45 cal. 7 in.	4 – 50 cal. 11 in. 8 – 50 cal. 9 in. 12 – 50 cal. 7 in.
	No Underwater torpedo tubes.	3 – Underwater torpedo tubes.
Protection,	Waterline belt 11″	9″
	Decreasing to 9″, 7″, 5″, 4″	7″, 5″, 4″
	Lower casemate and its transverse armor, 6″	8″
	Over 3 in. guns *in* superstructure and on gun deck, 2″	3″

"X"—Superiority of Proposed Type Battleship.

(69) After making all the changes above noted, let us see what sort of a type battleship we are finally to have when compared with the units of the Louisiana class, the displacement of which we intend to exceed by only 5 per cent.

I. *Armament—Offensive Power.* There is no escaping the fact that the battle energy of our new battery is greater by a very considerable factor than that of Louisiana class, and the writer holds its battle efficiency to be even more than the 18 per cent by which it excels in all-around striking energy per minute. We have introduced 100 per cent of torpedo efficiency, which must still further augment the offensive power of armament by a substantial amount.

II. *Protection—Defensive Power.* Leaving the battery out of consideration as a defensive factor, and neglecting the moral and possibly the material defensive gain made by including underwater torpedo discharge, we have readjusted and increased the total armor protection in such a manner as to produce a more logical and reasonable, and, it is believed, a vastly more effectively resisting arrangement of the protection and one which will very appreciably augment the value of the element of defense in summing up final power combination.

III. *Speed—Coal Endurance.* It cannot be successfully claimed that the proposed changes are likely to materially reduce the speed or coal endurance, especially if we might devote to motive power and fuel the weight it is possible to save from excess stores and spare articles and in various other ways. Supposing the motive power and amount of coal carried to remain the same as for Louisiana class, there would be little more displacement than the maximun of the Louisiana to be moved when our proposed type ship was carrying low coal or even a normal average amount of fuel. If we add slightly to the beam, as suggested without sensibly increasing the gross draft, it is possible to avoid a material alteration in the form of hull; and, where speed is not perceptibly affected by a difference of as much as 800 to 1000 tons in amount of coal carried, we need not necessarily expect our 16,900-ton ship to require so very much more motive power than we have given the Louisiana class of 16,000 tons trial displacement to secure a trial speed of 18 knots. The actual proportional increase to motive power weights for the 900 tons of extra displacement is about 84 tons. So the final total of extra weight required to make possible and practicable the new battery and protection suggestions does not appear to imperatively demand either more motive power or more fuel to get approximately an equal speed and radius of action. The writer believes that a sustained, all-weather, sea speed of 17 knots is quite sufficient for battleships.

IV. *Handiness—Sea-keeping Ability—Habitability.* The handiness of our proposed new type ship, with the slightly increased beam, cannot possibly have suffered (Brassey is authority for the statement that it has been discovered, "That the up-to-date big ship, of 16,000 tons or more, is *very easily worked and handled*"); and as the draft will be increased to a very limited extent, if any at all, our new ship should steer and turn admirably well. The seagoing and sea-keeping qualities will certainly be equal to those of the Louisiana class, and the habitability must be superior even where the total increase of displacement is relatively so inconsiderable.

(70) We have seen that our new battery adds 18 per cent to the fire energy, and the total battle efficiency of the armament must be substantially augmented by the inclusion of underwater torpedo discharge. The battle efficiency is manifestly increased by a considerable factor from the redistribution and increase to thickness

of important armor protection, so it does not look unfair to call the sum total of all-around improvement over the Louisiana class as much as 25 per cent, as against 5 per cent expended for displacement. Even if we regard the 5 per cent by which we have had to increase the displacement as so much dead loss in battle efficiency, we have sacrificed but 5 per cent of battle efficiency to gain certainly 25 per cent, which would appear, on the whole, to be a very superior sort of a bargain. Nor does the writer admit that the increased displacement is a loss, but entertains precisely the opposite view, namely, that it is a distinct gain since it has rendered possible the augmentation in efficiency of armor and armament by whatever amount it may be held that they are bettered.

(71) So with every argument apparently in her favor, our proposed new battleship would certainly appear worthy to become the type and standard, and she is submitted for that distinction entirely upon what are believed to be her intrinsic merits, and with every confidence and reliance upon her immense superiority to our present accepted type represented by the Louisiana class of battleships.

(72) If it should be decided to carry the 4-inch gun instead of the 3-inch, it will require about 100 tons more weight for these new guns and their mounts and ammunition than we now are carrying on account of the 3-inch gun; and, in such case, we should also have to make an addition of probably as much as 140 tons to motive power weights in order to be certain of the necessary horse-power to still maintain the desired trial speed of 18 knots. In case we do decide to carry the 4-inch guns, and to increase the motive power as indicated, the final grand total of weights to be carried will be 333 tons for all other changes plus 100 tons for 4-inch guns plus 140 tons for motive power, or 573 tons; for which final grand total of extra weights the necessary increase to displacement would be in the neighborhood of 1600 tons, resulting in a trial displacement of approximately 17,600 tons, and a gross load displacement of about 19,300 tons for a final standard type battleship embodying all the latest and most approved characteristic qualities.

(73) The displacement of such a final standard type battleship will exceed that of the Louisiana class by about 8 per cent, but the battery energy per minute of this vessel will (including the

4-inch guns) be 23 per cent greater than that of the Louisiana; and while this final type of vessel would have only about 6 per cent greater displacement than the King Edward class, her broadside battle energy will (as already stated) be 30 per cent in excess of the total striking energy per minute given by the vessels of that class, which vessels are the nearest congeners to the writer's proposed standard type battleship as yet laid down abroad. From this showing, it is not difficult to conclude that the predicted 20,000-ton battleship is not likely to prove a myth but appears to be an almost immediately realizable probability, especially if we should make our actual type battleship as powerful and formidable as she can be made and, at the same time, disregard the question of cost, which, as we have seen (Par. 2), may be held to be, for the United States, a practically negligible factor.

NOTE.—Since this article was undertaken, but not until same had been practically completed, it became known to the writer that England was about to lay down a class of battleships of 18,000 tons normal displacement, or, probably, about 20,000 tons full-load displacement. Although very meagre data is in hand as to these ships, it appears to be intended that they shall carry *eight* 9.2-inch guns (as the principal calibre of the intermediate battery) where our Louisiana class carries *eight* 8-inch guns. The sudden jump up, from King Edward class, in displacement is, of course, partly due to the more powerful armament, but is (so far as can be ascertained to date) chiefly intended to accommodate the heavier and more extended armor protection.

The bearing of these facts upon the writer's contentions in the present paper requires no comment beyond a mere statement of the fact that his position, in all essential particulars, is materially strengthened and secured by the advent of the latest class of British battleships.

"Y"—CONCLUSIONS.

(74) The whole contention comes right back to the one and only question involved, and that is, "Can our battleships of the Louisiana class meet the latest and best types of fighting ships from abroad and defeat them every time and all the time? Until an affirmative reply can be made to this query, we have not reached that all-around perfection of general design (i. e., final compromise among the essential qualities or elements constituting total power) in our type fighting ship for the first line-of-battle that we should attain, and to which the Congress and the country have a right to expect that we not only can but will attain. Anything

that we are able to suggest or to do, then, to promote and perfect the power and efficiency of the types for our armored construction may prove to be a step toward the realization of the highest possible standard for such types, and, with all modesty, the writer claims to have pointed the way towards what is believed to be a marked advance which it is feasible to make in this most important particular.

(75) To the initiated, it requires no explanation or argument to make it forcibly and entirely understood that the next war in which we find ourselves engaged will be the bona fide article and no mere naval reconnaissance in force; so it behooves us to prepare ourselves in the most thorough, painstaking and efficient manner possible for what will try-out not only commanders, officers and men, but every fighting ship and every single war appliance, or combination of appliances, of whatever kind or character we can devise, making the highest and utmost use of our best genius, talent, ability and diligence from now until the day the first shot is fired, be that soon or otherwise.

(76) In concluding this article, the writer desires to invite attention to a former paper, published in the PROCEEDINGS OF THE NAVAL INSTITUTE under the title "Size of Battleships for U. S. Navy," with the hope that the two papers may be regarded as mutually supplemental, inasmuch as the subjects which they respectively discuss are, from the nature of the considerations involved, so thoroughly interdependent.

(77) In these two papers, all possible pains have been taken, and every effort made of which the writer is capable, to state and record the imperative reasons and necessity for the type battleship of our navy—to which we must consistently adhere as a standard pattern to avoid fatal lack of homogeneity in our battle units—to be (not alone as to armament, but in every other regard) the most powerful fighting machine that can be designed on permissible dimensions and displacement and the best in every particular that money can provide.

(78) In adding to our battle units in the remoter future, only such gradual moderate changes should be made, in the general type now determined upon, as experience in or observation of actual war may dictate or the developments in naval progress make inevitable. If radical departures from present type become imperative, the units of new construction built after such modified

type must be provided in sufficient numbers to constitute separate, uniformly homogeneous squadrons, and thus avoid hampering and embarrassing our fleet and squadron commanders by furnishing for use in any one battle group, vessels of widely dissimilar characteristics as to offensive and defensive power, speed, radius of action, handiness and sea-keeping ability.

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U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

CONTINUOUS COMPASS CORRECTION AT SEA.

By LIEUTENANT-COMMANDER ROY C. SMITH, U. S. Navy.

The new Type VI binnacle, with fore-and-aft and athwartships magnets, makes compass correction by the tentative methods of Special Circular No. 55 a comparatively simple matter. Nevertheless, the navigator, in his first compass adjustment aboard a new ship, will find one or two small practical details missing, which will consume time in ascertaining, but which, if once tabulated, will enable him to keep the compass approximately correct all the time, even without observations.

Suppose, for instance, with head east, he finds by an azimuth that there is a westerly deviation of 4°. What does he do? He moves the fore-and-aft magnets a small amount up or down and notices the effect. After two or three trials, he gets them at the right height. Suppose he had a table of constants in which he found that for the given latitude, raising the magnets one-tenth of an inch made 2° easterly deviation on east. He would at once, under the supposed case, raise the magnets two-tenths of an inch.

With a similar tabulated value of the constant for the athwartship magnets, head north, he would at once correct the observed deviation on north. Similarly, suppose it has been found that moving out the quadrantal correctors one inch makes about 2½° easterly deviation on NE. That gives him the means of correcting the quadrantal deviation. The compass is now approximately correct. A swing for residuals will either show no appreciable deviation, or, should there be any, will enable him at once, with the aid of the constants already employed, to make such small additional changes as will leave the compass correct on all courses.

In practice, after the compass has once been approximately cor-

rected, the simplest way to re-adjust is to swing on eight points, finding the deviation on each. Then, to eliminate A, take the mean on north and south (changing the sign on south), which determines how much to change the athwartship magnets; and the mean on east and west (changing the sign on west), which determines how much to change the fore-and-aft magnets. To determine how much to change the quadrantal correctors, take the

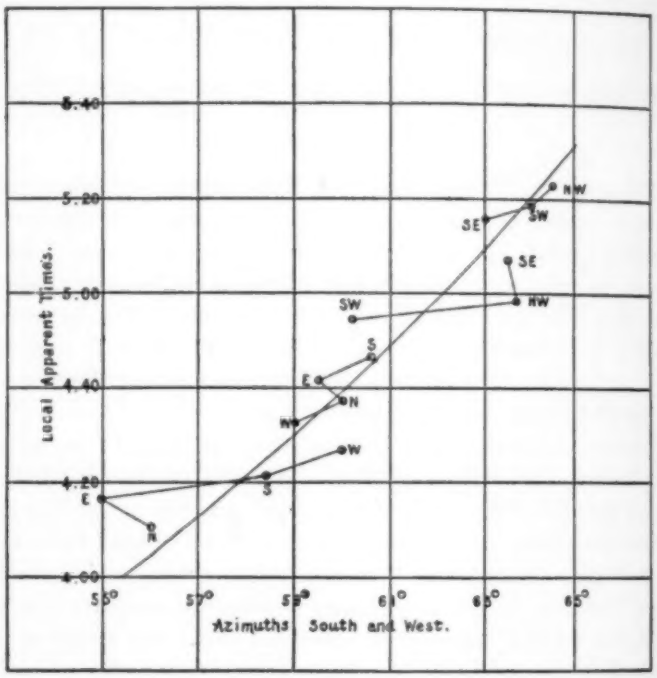


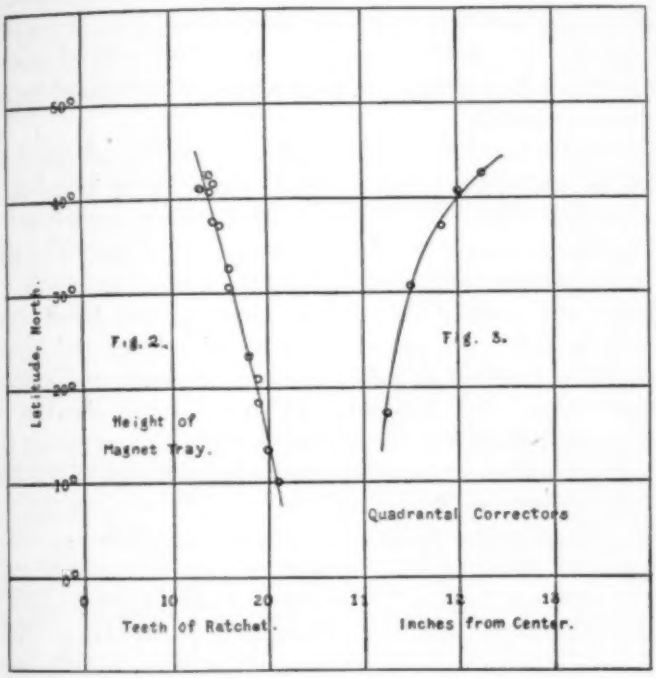
FIG. 1.

U. S. S. Massachusetts, off Nipe Bay, Cuba, December 28, 1901. Time-Azimuth Curve and Compass Azimuths for Ship's Head as Marked.

mean on NE., SE., SW., and NW. (changing the sign on SE. and NW.). The compass should now be practically correct, but it will be well to swing on the same points for residuals, as a final check.

Much time will be saved in this work by a simple modification of a detail of the tentative method. Instead of computing magnetic azimuths for given stated times in advance, it is quite as easy to make a curve on cross-section paper in which the ordinates are minutes of local apparent time, and the abscissae degrees of

magnetic azimuth, that is, true azimuths corrected for variation. Then for any given instant of time, the magnetic azimuth may be picked off directly from the curve. The difference between the magnetic azimuth and the compass azimuth is the deviation. The first swing should take 32 minutes (4 x 8). With 10 minutes to change the correctors and 32 minutes for the second swing, the whole operation should be finished in an hour and a quarter. A



U. S. S. Massachusetts, Adjustment Curves.

time-azimuth curve, as actually used aboard the Massachusetts, is shown in Fig. 1.

Next, it will be found convenient to keep tabulated a complete record of all changes in the corrections. The columns for this table are as follows: Date, place, latitude, height of fore-and-aft magnets, height of athwartship magnets, distance of quadrantal correctors, height of heeling magnet. In the course of a year or so of cruising, it will be found that a latitude curve may be sketched in for each corrector; that is, the average position of

the corrector will be shown for each latitude. Such curves, taken from actual experience aboard the Massachusetts, are shown in Figs. 2 and 3.

Theoretically, the quadrantal correctors are supposed to be fixed in position after one careful adjustment. In practice this is not found to be the case. Aboard the Massachusetts they have to be changed from 11¼ inches to 12¼ inches in changing from 17° to 43°, north latitude. It is possible that the correctors are not actually pure soft iron, but have acquired some small amount of magnetism. For this reason they should be marked *starboard* and *port* and kept always on their own side and turned the same side to the compass.

The Massachusetts is supplied with the old type starboard-angle binnacles, which necessitates a slight modification in the practice as above described. As it happens, the starboard-angle is approximately 180°. Hence raising or lowering the magnet tray affects the deviation on east and west, but not on north and south. The magnets are actually fore-and-aft magnets, and hence may be treated as described above. Instead of raising and lowering athwartship magnets to effect changes on north and south, the method aboard the Massachusetts is to rotate the tray very slightly, thus changing the starboard-angle. The constant is the amount of deviation caused on north by a change of one degree in the starboard-angle.

The constants for the Massachusetts are as follows:

Date.	Lat.	Raising Tray 1 Tooth. Head E.	Increasing S. A. 1 Degree. Head N.	Moving out Quad. Corr'r 1 Inch, Head NE.
1901				
Nov. 23.....	37.6° N.	(+) 2.9°	(+) 1.7°	(+) 2.3°
Dec. 28.....	21.2 "	(+) 1.8		(+) 2.8
1902				
Aug. 20..... ...	42.6 "			(+) 3.5
Dec. 3.....	18.3 "		(+) 1.8	
1903				
March	30.4 "	(+) 2.5		(+) 2.5

The heeling magnet may be placed by any of the usual methods. A good method, as used aboard the Massachusetts, was as follows:

With the ship heading north, she was listed several degrees to starboard by training the after turret, observing continuous azimuths before and after. She was then brought on an even keel and afterwards listed in the same way to port, continuing the azimuths. This was repeated with the heeling magnet in different positions, until the continuous azimuths when plotted to form a time azimuth curve showed as a smooth curve. With deviations due to a heeling error, the time-azimuth curve would show as an irregular figure lying on either side of the smooth curve, and would have to be smoothed out by changing the height of the magnet.

An example will now be given, taken from actual work, to illustrate the method. On December 28, 1901, off Nipe Bay, Cuba, in Lat. 21° 10′ N., the Massachusetts was swung on the cardinal points as follows: (See Fig. 1.)

N.	(+) 0.7° Ely.
E.	(+) 2.5° Ely.
S.	(—) 0.3° Wly.
W.	(—) 1.4° Wly.

No attempt was made to correct the small deviations found on north and south. The mean on east and west (sign changed on west) was (+) 2.0° Ely. From the table of constants it is seen that raising the magnet tray one tooth of the ratchet makes about 2° Ely. deviation on east; hence it would have to be lowered one tooth to correct 2° Ely. deviation. The tray was accordingly lowered from a total of 18 teeth to 19 teeth. On the next swing these results were obtained:

N.	(—) 0.2° Wly.
E.	(+) 0.7° Ely.
S.	(+) 0.2° Ely.
W.	(+) 0.2° Ely.

Next the ship was put on the intercardinal points, except NE., which could not be obtained on account of the shadow of the mast, with these results:

SE.	(—) 0.7° Wly.
SW.	(+) 1.3° Ely.
NW.	(—) 1.8° Wly.

The mean of SE. and NW. gave about (—) 1.2° Wly. to correct. The constant for moving the spheres is about 2½° Ely. deviation on NE. for 1 inch increase in the distance. On SE. the constant would be 2½° Wly. deviation. Hence to correct 1.2° Wly. deviation, the spheres would have to be moved in towards the center one-half inch. This was done with the following results on the next swing:

SE.	(+) 0.6° Ely.
SW.	(—) 0.1° Wly.
NW.	(—) 0.3° Wly.

The compass was now practically correct on all courses. In this case the semi-circular deviation was corrected before attempting the quadrantal. Ordinarily it will do equally well to swing on eight points and correct both together. The second swing will then give the residuals. The time required for this compensation was one hour and fifteen minutes.

After the latitude curves are once determined, the compass may be kept nearly correct all the time. This is useful in case of fog, or when making land after a considerable change of latitude when there has been no opportunity to swing. Azimuths must be taken as frequently as possible whether the compass is correct or not. No change from the usual practice is intended in that regard. Careful records aboard the Massachusetts indicate that the ship's permanent magnetism does not suffer any material change. There are slight temporary changes after target practice, and after lying for some months at the navy yard on the same heading. This is the so-called retained magnetism, but it disappears after a few days of ordinary cruising. In changing the correctors according to the latitude curves, it is usually advisable to keep a day behind, on account of the retained magnetism, the ship tending to retain for a short time the induced magnetism of the latitude left.

As a final example, the Massachusetts made a trip from Pensacola, Lat. 30° N., to Hampton Roads, Lat. 37° N., in April, 1903. After arrival at the latter place the magnet tray was set at a height of 15 teeth of the ratchet below its highest position, and the quadrantal correctors were set at 11¾ inches from the center. These positions are in accordance with the curves of Figs. 2 and 3. On April 28, three days after arrival, the ship was swung on eight points in latitude 36° 52′ N., with the following results:

N.	(+) 0.1° Ely.
NE.	(—) 0.4° Wly.
E.	(—) 0.7° Wly.
SE.	(—) 0.3° Wly.
S.	(—) 0.2° Wly.
SW.	(—) 0.1° Wly.
W.	(+) 1.1° Ely.
NW.	(+) 0.7° Ely.

The mean quadrantal was $\left(\frac{-0.4^\circ + 0.3^\circ - 0.1^\circ - 0.7^\circ}{4}\right) = -0.22^\circ$, which could have been corrected, had it been desired, by moving the spheres out something less than one-tenth of an inch. In practice it has been found convenient not to change the spheres less than an eighth at a time.

The mean on north and south did not require correction. On east and west the mean was $\left(\frac{-0.7^\circ - 1.1^\circ}{2}\right) = -0.9^\circ$. This could have been corrected by raising the tray one-half a tooth of the ratchet. In other words, the adjustment was as close as the appliances would permit. However, a small shim piece has been provided, which may be secured to the toe of the pawl, making the equivalent of one-half a tooth of the ratchet. By this means the tray was raised from 15 teeth to 14½ teeth, leaving the compass correct on every point within a deviation of less than one degree.

These curves are now habitually used aboard the Massachusetts with almost uniform results. Azimuths are always taken daily on whatever course steered, but principally as a check only. When the ship is long enough in one place, or time affords, a swing is made on eight points for residuals; and, by means of the table of constants, such small changes are made as may be shown to be necessary.

DISCUSSION.

"SINGLE DISPLAY TACTICAL SIGNALS." See No. 105.

Lieut. H. C. POUNDSTONE, U. S. Navy.—(1) I wish to express my indebtedness to Lieut. Mustin for putting before the service so concisely and intelligibly his excellent plan for a mast semaphore to parallel the night electric system and to so equip both systems as to permit all battle and tactical signals to be made in one display. I heartily applaud the ingenuity of his ideas and their application, and I believe in the practicability of the scheme as a whole when finally tried out and fully developed under service conditions.

However, I make *two* important exceptions to the general scheme as proposed by Lieut. Mustin, (a) as to the *shape* of his proposed elements, and (b) as to the advisability of *pulsating* elements to give special signification to a display, whether by day or night.

(2) One reason given by Lieut. Mustin for the visibility of his elements is that their shapes will present the appearance of a succession of military tops of differing diameter and height, which shapes are known to be distinctly recognizable at long distances; and said reason is, to me, the very strongest argument *against* the employment of such shapes! The long narrow arm may, at a distance, be easily mistaken for a signal yard and the broader arm for a top, searchlight platform or lookout perch; and a big element of uncertainty is interjected which seems, in a great degree, to nullify the attribute of reliability and to reduce the factors of simplicity and rapidity to which this system may, otherwise, fairly lay claim. Uncertainty as to the shape or color of a signal (or as to how much of a display is part of the ship or of the ship's ordinary lights as apposed to proper signal shapes and lights) is bound to lead to delay in making signals out, and any signal—especially at a distance—which shows one thing one time and something else *directly* afterwards, and then shows like original and so on—which is the case in pulsating an element—is *sure* to be confusing and to involve what may prove to be dangerous error in ascertainment and consequent delay—if nothing worse—to possibly the whole squadron in carrying forward some important manœuvre; and it is easily seen how doubly risky same would be when about to engage or when *in* action! To my way of thinking, the elements of such a semaphore as Lieut. Mustin proposes should present the *greatest possible contrast* to any outline to be ordinarily seen above the rails of our ships, and I would suggest that the element "one" (1) be represented by a *ball* (circular disc) of say *4* feet *diameter*, giving a visible area of 12½ square feet, and the element "two" (2) by a right *cone* with apex *up* (flat isosceles triangle) of 4 feet height and *8* feet diameter of base, giving a visible area of 16 square feet. *These* shapes can not possibly be confused with any ordinary shape or fitting attached to hull or masts, especially at the height they will be carried as part of semaphore. This question of shapes will be referred to later.

(3) As to my second exception to Lieut. Mustin's scheme, I consider it to be of the utmost possible consequence that *no* pulsation (or eclipse) of a shape or light should be a factor in *any* code of visual signals. On the other hand, fixed, staring, steady unchanging visibility is the main desideratum to be sought; and, once made, no alteration should be permitted in any display until shape or color is distinguished and the signal is understood and answered! Pulsation, or the eclipsing of a shape or light, diminishes, to a marked degree, the certainty and precision of any system with which employed, and hence reduces the dependable range of visibility at which such system may be safely worked! I am *unalterably* opposed to pulsation and always have been, as it introduces an undeniable element of weakness and unreliability; and, where more than one light or shape would be pulsated, the chances of error and confusion must be simply disastrous to efficiency; as certainty, and consequently the rapidity, is reduced to a low limit. Of course, pulsation (eclipsing) is the vital factor with all flash-light systems such as the heliograph, army field acetylene set, and with searchlight shutter and masthead "winker" methods, or any other form of flashing signals. However, such systems are (I believe) inherently undependable as compared with any steady display system. To any one who has ever had experience in trying to read signals sent by flash, my contention will be immediately apparent. The loss of even one flash (long or short), by reason of interference of a shroud, stay or piece of gear or on account of smoke, haze, light rain or other lights which may be in use (especially a searchlight), will destroy continuity, upset the meaning and produce lack of confidence in either the sender or receiver; and with the Ardois pulsator, for instance, all these drawbacks are intensified! Again, the "Rules" (I) for the use of Ardois provide for extinguishing or screening all lights (except speed indicators) which may cause confusion or interference; but how often is this done or can it be done without worse confusion as to speed and manœuvring? I remember an instance of the Yorktown trying—on a clear dark night—to feel her way into Kobe harbor with a forward searchlight, the running and speed lights being also visible. Her distance from the flagship, while attempts to intercommunicate by means of the Ardois were being made, varied from 2 miles to 400 yards, and though messages were many times repeated—on both sides—neither Flag nor Yorktown received any one signal correctly; that is, not even steady lantern displays could be made out, much less pulsated lights! Of course this is an extreme case but one not unlikely to occur. It may be absolutely necessary to communicate with a vessel by means of the Ardois when the weather conditions are unfavorable and when both sending and receiving ships are—of *necessity*—showing other lights, even perhaps one or both of them using a searchlight. Under such circumstances, I am certain of a task for the signalmen, especially where the signal involves use of pulsator!

(4) For reasons cited, I would not have it allowable to pulsate a speed light or *any* light in the night signal set! It is perfectly practicable to make the night speed significations without pulsating either light; for

instance, let white—as now—signify "going ahead at prescribed speed," white and red *together* to mean "slowed down," red *alone* "stopped"; and if it becomes necessary to back, turn off the red and give the whistle signal, "3 blasts." Thus turning off *white* now indicates out of formation, and if turning off red and sounding *3* blasts were the signal for backing, we should have it understood in *both* cases where no lights were showing that the ship was out of formation and temporarily out of position, the latter of which she necessarily is when she backs. The reappearance of red, red and white, or white lights will indicate with *certainty* what the engines are doing and there is thus no occasion to pulsate either the red or white speed lights. This proposition with reference to speed lights, would involve changes in the present controllers, but *whatever* conduces to safety, certainty and efficiency in handling big ships together is manifestly justifiable as to expense.

(5) Having indicated my general agreement with Lieut. Mustin's plan to make all battle and tactical signals in single displays, but my disagreement as to the shapes proposed to be employed and my intense disbelief in and distrust of the idea of pulsating lights or semaphore discs, I will proceed to outline how I think the same end may be attained in another way.

(6) As noted in Par. 2, I would make the element "one" a ball (appearing as a circular disc) and the element "two" a right cone (appearing as a flat isosceles triangle) the visible area of which to be approximately the same as that of the ball. Neither of these shapes can possibly be mistaken for anything else carried at approximately the same height and they will show same outline in all directions. *Then*, instead of *pulsating* an element or elements to give a distinctive meaning to a display, I would introduce *over each pair of elements* a third conventional shape, same to be *exhibited* whenever it is intended that either of the elements under it (i. e., whichever one forms part of a display) should have a special meaning. For *this* purpose I would suggest the use of a drum or cylinder whose diameter and height should be equal (say 4 feet, giving 16 square feet of visible area) and which would appear as a *square* disc. For convenience of reference, I will call this shape a "*specializer*," and same would be worked from the same keyboard but independently of the operating mechanism of the semaphore proper; however, the specializer wiring, etc., should be installed alongside of and in conjunction (but not connection) with the wiring and control appliances of the semaphore. The appearance of the specializer over an element—but *always* as a *steady* part of the display—would give that element and the entire display the special meaning which Lieut. Mustin proposes to get by pulsating the element.

(7) As a *night* "specializer," for use with the Ardois and similarly to avoid pulsating *any* light, I would install *over each pair of double lanterns* a *green* lantern (lens) containing a Geissler tube lamp; that is a proper "Geissler tube," the running, *flaring* light of which would be transmitted through the lens as *green*. I would have this set of *night* specializers operated from alongside of the Ardois board or telephotos in same manner as for day specializers and the semaphore, and I would remove *all* pulsating

keys from the masthead "controls" and night signal sets! It is worthy of remark here that the *speed* of signaling with the Telephotos is from two to *three* times as great as that possible with the Ardois keyboard, with which latter it is simply out of the question to make decently rapid work. The green light, pure and simple, if used for a specializer, would not give sufficient color, distinctiveness or visibility; but, if the arrangement is fitted to give a Geissler tube effect to the light, *green* will be clearly and unmistakably apparent at much greater distances than the ordinary red and white lights of the night signal sets! I have had abundant opportunity to see (observe) the workings of night signal sets from Russian war vessels, *all* the lights of which (red, white and green) were produced in this manner; the results manifested are surprising and the distance at which such lights are plainly visible (*certainly* up to 15 miles) is astonishing, and made me wonder why we had not tried something of the kind before now. A single specializer at *top* of Ardois and over *each* double truck speed lantern will cure the *present* uncertainty attending use of pulsators. If the specializers were extended to the speed lights, they would be *exhibited* where truck lights are now *pulsated* but a red or white light would always *show* under the *specializer*, and the latter should be (for truck lights only) a *blue* lens and Geissler tube lamp, to distinguish it from the *green* specializer of night signal sets. The day specializers and night *Ardois* specializers may—if shown singly or in combination—be given special significations, or used for speed signals in case speed shapes or lights fail to function properly. For instance, the top specializer might be made to signify "going ahead at prescribed speed"; *two* at once, "slowed down"; *three* at once, "stopped," and all *four*, "backing." The blue masthead specializer, shown *alone*, may be made to mean "man overboard"! Attention is called particularly to the fact that the inclusion of the night and day "specializers" does not in *any* way affect the use of the proposed semaphore or the present night signal sets for sending *any* kind of signals to which they are now adapted! The specializers simply extend—in a *positive* manner—the scope of *both* sets. I am entirely certain, just the same, that there will be a "howl" made on account of *alleged* complication in apparatus, increased room necessary for installation, too much gear aloft, expense, too many lights and shapes showing, etc., etc., etc., to all of which I may say—in advance—that I merely offer this suggestion as a possible solution to the problem involved by abolishing pulsation which *I* consider as wrong in principle and worse in practice. The suggested solution is one that appeals to me as being entirely practical and feasible and worthy of adoption if it does the deed, and it *will!* The extra cost to a day set will be comparatively small, and relatively less (I should think) for a night set; and new night apparatus can be made to include the specializer control on the same keyboard with the alphabet, etc., and a corresponding arrangement may be made for the semaphore sets when they are finally worked out. Right here it, and in connection with the subject of keyboard control, it is proper to call attention to what seems to be a fatal omission in our night signal sets, and that is the failure to provide means for producing the display, in miniature, *at* the keyboard,

coincidently with the mast display. Now, the sender is never *certain* what is actually showing unless informed by a signalman detailed for the purpose. At present, even in our large ships, it is difficult to find good signalmen in sufficient numbers; and the number on watch at any one time is, therefore, limited and generally less at night than by day; so that when it comes to making an important night signal to a squadron of any size, the available signalmen have their work cut out to keep the run of the other ships, and it is perfectly possible for the sender to make mistakes which may mean nothing or may convey just the opposite meaning from the real intent of the proper signal, and the result might well lead to disaster. It would be a very simple matter to include with each keyboard, whether for night signal sets or day semaphores, a small vertical panel with miniature reproductions of the night lanterns in their proper color and position, and of the day shapes in proper order; these last to be made by illuminating a circular aperture containing a darkened glass disc with the figure of the shape in white. This will assure the operator of what he is doing and prevent error to a large degree, and will make it permissible to locate the sending station *in* the signal tower or some other well protected place, to which the report of "signal answered" can be made by voice-pipe, call-bell or telephone; but wherever the sending station *may* be, it should be the same for ordinary as for war conditions.

(8) As indicated in Pars. 2 and 6, I would make the diameter of ball (element "one"), height of cone (element "two") and the diameter and height of drum ("specializer") all the same and equal to *4* feet; the diameter of base of cone to be *twice* its height. This scheme of shapes will require that each circular, triangular and square disc (representing a ball, cone or drum) be nicely proportioned for *each* side of the trilateral and equilateral display, in order that they may present the same unmistakable form at any point from which viewed, and the highest attainable result in this regard is reached where the vertical axis of the shape coincides, from *every* direction, with the axis of the topmast. It will thus be seen that we have come around again to the question of *shapes* for visual signals, especially for long distance communication, whether the shapes are *collapsible*, or otherwise reduced to practical invisibility as by turning their disc equivalents into lines in the horizontal plane as proposed by Lieut. Mustin. This matter of collapsible shapes was thoroughly discussed in the PROCEEDINGS years ago by Lieut.-Comdr. Niblack, and its advantages over any other system well set forth. His ideas were evidently ahead of the time for *our* navy, though we were *then* much behind the Germans and others in facilities for distant signaling. Fact is, we had *no* way of making distant signals with certainty, nor are we *much* better off to-day.

(9) As an alternate or substitute for Lieut. Mustin's system, and only in elaboration of his general idea, which is splendid, I would propose a *combination* day and night signal set of collapsible shapes (balls, cones and drums as already indicated) and lanterns; the shapes to *surround* the topmast (i. e., have their vertical axes coincident with that of the mast) and the green, red and white lanterns to be so placed on and around the mast that they will occupy the center of the shapes when the latter are

distended, and be *quite* and *entirely unobscured* by the shapes when such shapes are *collapsed.* This will—in order not to occupy too very much vertical height—require shapes to collapse vertically, either up or down; the specializers will collapse *down,* the top element ("one") of each double set will collapse upward and the bottom element ("two") will collapse downward. This method of combining the shapes and lanterns (the double red and white lantern being placed so that either *shape* element "one" or "two"—as may be required in the display—will have its corresponding lantern at nearly its mean vertical height when shapes are distended) will permit us to use the shapes *also* in making *night* signals. For this purpose, the collapsible walls of shapes should be made of translucent waterproof material; and when the shape is distended over and around its corresponding light the *whole area of shape* becomes an *illuminated* signal shape of the proper color. If it be remembered at what very considerable distances, in the air, small paper balloons, imperfectly illuminated, may be seen at night, the merits of this suggestion will become apparent; and the practical working out of such a *combination* day and night signal set offers no insuperable obstacles! As already stated, the shapes, *when collapsed,* are quite clear of the lanterns so that the operation of the *night* set *without* using the shapes is provided for; and to assure their *joint* or *independent* operation, as desired, the keyboard connections may easily be arranged to cut in both sets *together* or either set *singly,* making the system sufficiently elastic to insure day manipulation of the shapes *alone* and night manipulation of the light set *only* or both sets *together!*

(10) The present night signal set can be *much* improved by increasing the intensity (candlepower) of the lamps, i. e. by installing a single lamp of say *100* c. p. or two single lamps of *50* c. p. in *each* lantern. This would *help* to differentiate the lights of signal set from other lights carried or shown, besides increasing the range of visibility of the night sets. For the proposed *combination* day and night set, it will be necessary to install *3* lamps or *3* sets of lamps to *each* lantern, at (say) angles of 120° apart in horizontal plane; and I would favor *3 double* sets of lamps of not less than 50 c. p. per lamp. The value of a night signal set is so dependent on the intensity of illumination of the lanterns that I am surprised we have so long contented ourselves with 32 c. p. lamps which limit the effective distance of our present night sets to about *2* miles under normal conditions. We should certainly have night signal *lights* which would be plainly visible and distinguishable at *5* miles.

(11) In case of the adoption (for trial) of the specializers and the installation of my suggested shapes on the plan proposed by Lieut. Mustin for an *independent* day semaphore, the space (vertical height) necessary to accommodate the set complete will be as follows, assuming the dimensions of said shapes to be as already noted: The height necessary for a *group,* that is, a specializer and two elements ("one" and "two") will be *10* feet, with specializer and bottom element distended; for, the two elements (1 and 2) may have their horizontal axes but *two* feet apart inasmuch as they are never exhibited coincidently; for the *4* groups we should

then require *40* feet; and, allowing a ***minimum*** height of *6* feet between groups, we shall need *18* feet more, or a total vertical height of 58 feet, which same can *easily* be had, clear of all obstructions except the smokepipes, on the 130 foot (or higher) masts which are to be fitted for the wireless sets. It seems very improbable that we shall have fighting tops on our masts *hereafter*, and the high pole masts will afford ample, clear vertical space for such an installation as that just noted or for the combination day and night set which I have outlined. As to the vertical space (height) necessary for the *combination* day and night set, it will be *only* 50 feet, the double element lantern coming (installing) where the horizontal axis of top element (number "one") of each group installs on the independent day semaphore, thus saving *2* feet of height for *each* of the *4* groups, or *8* feet in all. The shapes representing the elements of the combination set occupy the *same* (a common) vertical space when distended; shape-element "one" distends *downward* over the common space and shape-element "two" distends upward from the lower end limit, the double lanterns being at the *mid* position! *All* of the shapes of the combination set will, therefore, show above and clear of the smokepipes, unless tops of latter are over *100* feet above the grate bars, which I believe they never will be. The proper size for and spacing of the shapes of independent semaphore and of the shapes and lanterns of suggested combination set, to assure greatest visibility, can best be worked out by experiment, and the questions of wind resistance, materials, weights of stationary and moving parts, certainty of action and the methods and means of operation may be determined at the same time and as part of the same problem. A minimum distance of *6* feet, between groups of shapes and lights, is assigned for the reason that the "International Rules for preventing collisions" require not *less* than that distance between two or more towing lights in order that they may all be visible and distinguishable one from the other at least five miles. It is hardly necessary to add that the distances between groups, as well as the vertical distance between the shapes or lights of any *one* group, should be all that the conditions of installation will permit, so that the range of distinguishable visibility may be the highest possible.

(12) In both systems, it would be well to so arrange their construction and installation as to provide for "housing" the sets, in heavy weather, as low down on the masts as possible. It will also be necessary to have graduated *sizes* of the installations, so far as dimensions and spacing of shapes is concerned, and probably also as to sizes of lanterns, for different *classes* of vessels. Such graduated sets may be large, intermediate and small; the *large* size to be used on 1st and 2d rate ships, the *intermediate* size on 3d and 4th rates, and the *small* size on destroyers, 1st-class torpedo-boats and other small vessels that must operate in conjunction with the fleet.

(13) While on the question of "shapes" for signal displays, I would like to suggest a new method for making day speed indications to replace the present slow, uncertain and clumsy yardarm speed cones! My suggestion would be to install, on the *fore* topmast, *4* double right cones

joined base to base (showing diamond shapes all around the horizon), each *cone* to have a height of *2* feet (or a total *height* of *4* feet for each diamond shape) and a diameter of base equal to approximately *twice* the slant height to permit of easy and compact collapsing. I would make the installation so that upper vertex of top diamond should come *well* up to eyes of upper rigging, at topmast head, and the remaining diamonds to follow *close* below the top one, with their bottom and top vertices almost or quite touching when all were distended; collapse of each shape to be double and on to the plane of the common base of cones. Manipulation may be mechanical or electric, or both, in order to insure certain, *positive* action. The control would, of course, be on the forward bridge under the eye of officer of the deck; and the exhibition of *one* diamond should signify, "going ahead at prescribed speed"; two diamonds to mean, "slower than prescribed speed"; three diamonds, "engines stopped," and four diamonds, "engines backing"! If considered advisable, the suggested speed indicators may be made of such material that when lighted they will serve also at night, in case of a breakdown to both masthead speed indicators; and, should *all three* methods fail, the specializers may be used (temporarily) to give the speed indications. Such an arrangement will, on account of its height and distinct visibility, *always* enable speed signification to be seen from *every* direction; there will be no shifting across of cones; no clumsy hauling down, inverting and rehoisting to be done; the bridge will not be crowded with an extra cone and the men to work both, and the yardarms forward will be left quite clear for rigging a helm indicator which we seem to have abandoned just as we are commencing to need it most, that is in close formations of divisions, squadrons or fleets. I would have the helm indicators consist, preferably, of *18-inch* green and red balls travelling vertically on *taut* jackstays from the yardarms and operated from a drum connected with helm control; the balls to be covered with sufficiently translucent material to permit them to be used at night when lighted with green and red lanterns, or to have green and red lanterns suspended *from* them and fitted to travel on their jackstays; the lantern lamps (in either case) to be electric, with circuit wires stopped up to the jackstays as far as lower (hardover) limits of lamp travel of their respective lamps.

(14) In conclusion, I would like to invite particular attention to the possibilities involved in the use of the searchlight (swinging beam) for making night wig-wag signals. Using the beam of a *second* searchlight for an index, it is possible, under favorable conditions, to communicate with certainty—even over high ground or other obstructions—up to distances of 50 miles and upwards. A long message sent to Cavite from the New York, then lying off Manila, was easily read by the officers of the Paragua, at sea, *45* miles distant to the southward and westward, though a range of moderately high mountains intervened.

(15) While awaiting the development of a combination day and night signal set consisting of shapes and *well* lighted lanterns, I hope to see Lieut. Mustin's semaphore rigged on a number of vessels and tried out to success, though I feel certain he will finally agree with my suggestions

as to the *form* (shape) of the elements! Lieut. Mustin's proposed arrangement and construction of the Tactical Signal Book, to correspond with his day or night system, is practical, easily understood and safe, and the whole scheme is sound, to my mind, except as to *pulsating* one or more of the elements displayed! If *this* can be overcome in the way I suggest, or by *any* other means, we should have an admirable system and one unsurpassed for speed and efficiency.

Lieut.-Commander A. P. NIBLACK, U. S. Navy.—Lieut. Mustin has planted himself on sound principles and given us a practicable and ideal four-arm semaphore. By his ingenious method of "pulsating" the arms, he has solved one of the most baffling difficulties in day visual signaling, if his apparatus is successful.

If I were an "ologist" of some kind and he had discovered a new genus, I could not be more enthusiastic over it than I am over the (to me) new argument he advances in favor of the wig-wag when he says "a wig-wag signal can be sent from behind a trench or any kind of protection without the least exposure to the signalman. In sending a hand semaphore signal all the vital parts of the signalman must be exposed." This exposes the vital parts of the new fad we have picked up in experimenting with the British hand semaphore, and warns us to adapt, not imitate, to "copper," not copy, to invent new methods of transmitting our code, not wobble around, or, as I said recently, "we would hear less about foreign signal systems which triumph by expertness in spite of *methods* inferior to our own."

It would seem that the time is now ripe for a board (as suggested by Lieut.-Commander R. C. Smith in a recent discussion) to take up the signal question and still further simplify it. No board would now want to wander from the modified Myer code. With Lieut. Mustin's clever modification of Commander Fiske's four-arm semaphore, we can now renounce shapes and day fireworks as idle dreams, *if* the long and short arms of different shapes will operate ("pulsate") in a moderate gale. The PROCEEDINGS OF THE NAVAL INSTITUTE contain articles and discussions on the signal question covering nearly all the points at issue. Commander Murdock has recently said all there is to be said on the two-arm masthead semaphore, and Lieut. Mustin's work would seem to dispose of his argument. If some one will kindly invent a perfectly satisfactory shutter for a lamp, we would have the "winker" light, so useful in night signaling. It has already been adopted as a method, but the problem lacks a solution in a shutter. Lieut.-Commander R. C. Smith has suggested recently a very acceptable flag code. Lieut.-Commander Mulligan's four element Very pistol code is now a fundamental part of our modified Myer code. Lieut.-Commander Gleaves has pointed out the need of *modern* marine glasses of great power as doing away with the necessity for more conspicuous signal elements. My own suggestion of the Austrian method of interpolating flags in a hoist to represent *thousands* place in the numerals does away with the telegraphic dictionary, geographical list, and navy list code calls; eliminates the bracket from the Very pistol code; drops out several

flags from our present code; and makes all signals "general" in their significance.

Lieut. Mustin now raises the question of the tactical signal book by proposing a new code in which he overlooks the admirable French method. They use at night a four lamp (red and white) electric system in which four lights are shown in all displays. Each red and white light can be displayed (1) as a steady light, (2) as an occulted or slowly blinked light, or (3) as a rapidly flashed or winked light. With three characteristics to each red and white light the code gives several thousand distinct displays of four lights.

Let me assure Lieut. Mustin that his new code for the tactical signal book will, however, never be needed for the simple reason that the present tactical signal book must soon be replaced by one you can carry in your head or, if necessary, "paste in your hat." I am sure he does not want to give us a new burden in signaling if it is not necessary. He deserves a gold medal as it is for his clever four-arm semaphore and especially for attaching it to our present electrical night signal box. If the semaphore *works* under all service conditions, he can rest on his laurels for he has given the one thing which has been lacking to make it possible to reduce the number of tactical signals to a minimum, and has done away with the necessity for the very code which he feels called upon to create as a new burden.

The time will be verily at hand to form a board to revise the general and tactical signal books, when the four-arm semaphore, such as described, is found to work satisfactorily, and there will not be needed "four pulsators in the Ardois Keyboard instead of one."

You can do anything with the modified Myer code of thirty characters. What we want are methods. The one described by Lieut. Mustin has been a long time coming. If it has arrived our troubles are about over as far as signaling is concerned.

Lieutenant W. C. Cole, U. S. Navy.—Lieutenant Mustin has made a valuable invention. One that will greatly facilitate the rapid transmission of tactical and other signals at distances that are to-day impossible. "I," "T," "N," "A," "Y," "Z," and "cornet," are displays in which but one element is used. The elements do not vary in their shape, except by comparison. In order that there be less chance of confusion, I would suggest that the element of the "long and narrow arm" be painted with alternate black and white horizontal stripes, and the element of the "shorter and broader arm" be painted with alternate black and white vertical stripes.

I hope that the idea may be given a trial, in the near future, on board the ships of the battleship squadron.

"A Naval Training Policy and System." See No. 105.

Commander Henry McCrea, U. S. Navy.—Nothing but praise have I for the admirable Training Policy suggested in Lieutenant Reid's exhaus-

tive article. My one criticism is the question, Can we afford the *time* just at present?

There can be no doubt as to the almost vital importance of trained men for the service, and my idea would be to shorten the course on the training ships, making it just long enough to develop the *elegibility* or *aptitude* of the recruits, then draft them to our cruising ships. This will eliminate many triflers and prevent much changing in ship's companies. The men will advance under the supervision of the commanding and divisional officers, if the rules for such advancement were (even) temporarily modified, and this incentive would be a strong one for good men to exert their best energies.

I don't think an increase of pay all along the line at all necessary, and our navy ration is certainly excellent, so the incentive of *promotion* and a naval career without long waits should appeal to our enterprising youths very strongly.

I am sure the service will welcome a uniform system of training men, for homogeneity cures many evils.

Lieutenant W. S. TURPIN, U. S. Navy.—Lieutenant Reid's paper on "A Naval Training Policy and System" is most interesting, and the service should thank the author for the thorough manner in which he has treated the subject.

Nothing is more important to the service than the training of its personnel, for it must be admitted that we cannot hope to enlist trained men but must rely entirely on recruits.

As the author points out, the present methods leave much to be desired and there is the greatest need for improvement, but as to what form this improvement shall take is still open to discussion and should receive the earnest attention of the service, for unquestionably the officers alone are responsible for the efficiency of the enlisted force of the navy.

We cannot hope to bring the recruits up to the old standard of a deep-sea sailorman, nor is it necessary that he should be able to handle spars and sails with the same amount of skill, but there are many other things that have to be learned to take the place of that knowledge, and training is necessary to teach those things.

In order to comprehensively follow the author's views I have in each case, where there is any disagreement, and in fact in all cases, taken the divisions in the same order that he has put them in his paper.

The need for a training system cannot be denied, and every one in the service recognizes its necessity.

Personally, I don't think sailing-ship training necessary and a cruise on a deep-sea training-ship, commissioned for training alone, is an absolute waste of time which can be used to much better advantage on the regular cruising ships of the navy.

I thoroughly agree with the author that a training station, with small auxiliary vessels attached, is far preferable and will accomplish far better results, in a shorter time, than we can possibly get from using deep-sea cruising training-ships.

Our present system has many faults, and the remedies are not always apparent, as so many conflicting conditions confront us that it is frequently difficult to choose among a variety of evils and differentiate between the different degrees of harm each does.

Beyond question the source of supply of our recruits should be the same, and the enlistments should all be for training, but I cannot agree with the author that they should be similar to our apprentice system, for the landsmen produce a much superior lot of men. The reason for this is not far to seek, and does not lie in the training, but in the method of enlisting. Perhaps if we could afford the time to give the apprentices a chance to grow we might get a good lot; but we cannot do that, and must have men and able-bodied men at that. In the first place, they are entirely too young, and, in my opinion, no one should be enlisted who is less than 18 years old and the requirements in regard to size should be fixed high and rigidly adhered to. There are exceptions, of course, to the statement that the apprentices are not so good as the landsmen, but they are the exception, rather than the rule, and most of them that are better are now warrant officers.

To quote from the author, "Twenty years ago the present system of apprentices was established through the efforts of Rear-Admiral S. B. Luce and others, and has struggled along until to-day it is on a firm basis. Another system, the landsman training system, exists alongside it and is much less extended in its training; and in its present condition can never produce the same results." The author is very much mistaken about the results produced by the landsman training system. Not only does it produce results equal to the apprentice system, but, in my opinion, they far surpass those produced by the apprentice system. As an example I will cite the case of the Indiana. Out of a total deck force of 269 men, 193 of them are either landsmen for training or have been rated ordinary seamen from landsmen. The ship has been cruising in company with the North Atlantic fleet for four months and her work, as concerns the crew, compares most favorably with that of the other ships in all respects. These men were received on board direct from the training-ship and had an average service of about six months.

That there is room for improvement cannot be denied, but the road to improvement lies in the increase of the landsman training system until it finally supersedes entirely the apprentice system. Call them landsmen or apprentices as you will, the term is not important, but make the enlisting age such that we will not get children and expect them to be able to do a man's work.

The author says that promotion should not be too rapid. Here I disagree with him entirely, the more rapid the promotion the better, provided, of course, the men to be promoted are qualified. I cannot see that time or fairness to the apprentices, or any other class, cuts any figure in the promotion of any men, and ability alone should decide whether a man should get a certain rate.

There seems to be no good reason for changing the titles of the various

ratings; in fact, I think that it would be a mistake to drop titles that have become almost as much a part of the service as the ships themselves.

Another place the author says "'Youth' is the prime requisite in our recruits." This is true to a certain extent, but there is such a thing as too much "YOUTH" and that condition is much too frequently found, for the good of the service, among the apprentices. Again the author says, "All must start young and all must have a chance to rise to the top." This is certainly true, but care should be taken that they don't start too young, for we cannot afford the time to turn the service into a nursery for the taming of every young rascal whom his parents cannot manage. Again let me reiterate that we want men, not children.

Instead of changing the names of the rating as suggested by the author, make all the enlistments alike and the ratings will take care of themselves.

After discussing our needs the author comes to a system for supplying them. This proposed system is excellent in all but the one very important feature of the time required to turn out the recruits. That seems much too long, and particularly so when the percentage of re-enlistment is proportionately small. One-fourth of the time is taken up by the preliminary training. This time can be very materially shortened by limiting this training to individual instruction in what might be called the elements of the profession. The general information of the recruit will not be as great as it would be if the proposed course were followed out, but general information does not increase the efficiency of the ship to any great extent. In the ideal ship each man has one thing to do and all training should be towards bringing this particular job to the front. The more perfectly this is done the nearer we approach the ideal, and the more efficient the ship will be. This cannot be taught on training-ships, therefore it is better to limit the preliminary training, and get the recruits aboard the regular ships at the earliest possible moment.

Six months seems ample time to give to this part of the work, and that should be at a station with the necessary auxiliaries at hand to make the work possible.

The author deserves great credit for the thorough and elaborate manner in which he has gone into details and worked out the plans of the unit training station, and every officer in the service should do all in his power to bring about an end which is so much needed and which would so vastly increase the efficiency of the service.

Commander J. B. MURDOCK, U. S. Navy.—Mr. Reid's paper is a most valuable contribution to the training discussion, and is both comprehensive and well digested. His long experience in the apprentice training service renders him an excellent exponent of the views of many officers who have been similarly employed, and gives his opinions weight.

While agreeing most thoroughly with Mr. Reid's views in general, I must differ in one point most decidedly, and this is in his proposed plan of sending apprentices to duty in the service without any preliminary training *at sea*. The suggested plan of having sailing and gunnery auxiliaries attached to each training station as substitutes for cruising training

ships is, in my opinion, a mistake in theory, and impracticable as well. The recruit should be kept in barracks until he has mastered all that training ashore can give, and should then go to sea, and receive there his preliminary training in sea life, and in acquiring the "sea habit," which, as expressed by a recent writer in the Naval Institute, largely consists in obtaining a practical acquaintance with the discomforts of sea life, and in learning how to adapt himself to them. This is a very different thing from acquiring a little smattering of sail drill by daily trips around a harbor in an "auxiliary." The six weeks allotted to this work is wholly insufficient for getting one's sea legs on, even if all spent underway, which is impossible with the number of officers allowed. The present general system of taking recruits on an actual deep water cruise appears greatly preferable. By taking the time allotted by Mr. Reid for both auxiliaries, and by making gunnery training a part of the training instruction, it is possible to make a four months' sea trip, and the experience thus gained is vastly more practical than could be gained in an auxiliary employed in harbor work. Such auxiliaries may play a valuable rôle in the instruction of the shore station, but can never compete in practicable solid instruction with that obtained in a cruising ship at sea. It is, by the way, in no wise essential that training ships should pass half their time in port, and many do not.

As a further argument against the auxiliaries is the fact that in Chesapeake Bay, as well as in Narragansett, climatic conditions render winter cruising impracticable. Winter work in seamanship must be done in warm climates, and the proposed auxiliary method cannot therefore be carried out as outlined, and would result in recruits being sent into the service with no practical training in seamanship.

The retention of the training-ship does not necessarily increase the total time of fourteen months allotted by Lieutenant Reid for the training of the recruit. It does, however, eliminate his proposed economy in officers and men, and thus materially affects his whole plan. Nevertheless I cannot but think that some kind of practicable training at sea is an absolute necessity if the recruit is to be sent into the service in a condition to do work.

This leads to what in my mind is the gist of the whole matter. The navy needs trained men. The recruit should come to a battleship with enough training and practicable knowledge to make his presence an addition to the strength and efficiency of the ship, not a weakness. His ignorance, insubordination, irresponsibility, and general boyishness should have all been lived down in the training service so that he can go aboard ship as a man, capable of doing what Lieutenant-Commander Knapp has called a "sea man's" work. It is the weakness of the apprentice system that it does not meet this requirement. Instead of keeping its boys at home, it sends them into the navy, where they are more or less of a nuisance and care for a year or two, and are incapable of making, for some time to come, any adequate return for the training they have received. No officer will question the great benefit the apprentice system has been to the navy, but this does not affect the fact that some modification might give better results.

It is at present unquestionable, as Mr. Reid states, that the training of landsmen is in an unsatisfactory condition. It is no less certain, however, that most officers having the efficiency of their ship in view would prefer a landsman after nine months' training to a second class apprentice after twelve months. The latter, with more and better training is less efficient, for the simple reason that they are sent as boys to do men's work. The trained apprentice twenty years old is a very different creature and his efficiency is shown by the fact that he is generally a petty officer. The complaints referred to by Mr. Reid, that apprentices are not treated as men, and are not advanced as rapidly as landsmen, are tacit recognitions of the fact that they are not men, and from this very fact are not so well qualified for promotion. It is idle to assume that any discrimination exists for or against any class of men in the navy. The best man wins.

If the landsman is, on account of his age and manliness, a better unit of a ship's company than a youthful and boyish apprentice, in spite of the fact that he has received less training, cannot the interests of the service be best promoted by two changes which will bring the two classes nearer, viz., giving the landsman better preliminary training, and raising the age of enlistment of apprentices, so that time and labor need not be thrown away on boys. It is sometimes claimed by the advocates of the apprentice system that it is necessary to start training boys in order to procure the thorough assimilation with sea life, which will lead men to adopt the navy as a life employment. While enough ex-apprentices have re-enlisted to give this theory a partial verification, it is notorious that the vast majority are not assimilated, but return to life ashore. This being so will not the efficiency of the service be promoted by training recruits to render good practical service during their first enlistment, the only one we are sure of? This belief has been brought home to me, and the end desired could be attained by enlisting no one under eighteen years, making all enlistments for four years, and giving all recruits on their first enlistment the training now received by apprentices. Every man not discharged as "undesirable" would then be under training about one year, and render three years' efficient service, and the character and homogeneity of our ships' companies would be greatly improved.

"Size of Battleships for U. S. Navy." See No. 105.

Lieut.-Commander J. H. Gibbons, U. S. Navy.—It is unfortunate that this essay was not at hand during the recent controversy between the Senate and the House of Representatives as to the tonnage of our new battleships, when representatives from the board of construction were called in at the eleventh hour to strengthen the hand of the House committee on naval affairs in its contention that the Senate's demand for 13,000-ton battleships was untenable. The result was a compromise, and, as in the case of submarine boats, the navy was powerless to engraft its carefully considered ideas upon the holders of the public purse.

As Colonel Cuniberti, the eminent Italian naval constructor, truly says: "Few of the lecturers and compilers have taken into account the financial

and technical side of the question, although it is of such great importance, *especially in the case of the less wealthy navies.* But even the richest ones are limited in their appropriations, and within such limits they have to solve the same problem, *though on a larger scale,* and for that reason in a more conspicuous manner." These remarks are interesting because it is Col. Cuniberti's design of the Vittorio Emanuele that has turned the attention of other countries toward smaller displacements. On paper the Vittorio Emanuele is to have 12,625 tons displacement, is to carry a main battery of two 12-inch guns in separate hooded barbettes and twelve 8-inch guns in pairs in turrets, three on each side; is to have a complete armor belt of from 4 inches to 10 inches; side armor of 8 inches and barbette and turret armor of 8 inches, and is to have a maximum coal capacity of 2800 tons, and a maximum speed of 22 knots. As a "less wealthy navy," Italy, since 1878, has been bobbing up and down in the matter of battleship displacement, beginning with the Dandolo of 12,071 tons, increasing to 15,549 tons in the Lepanto class, dropping to 11,000 tons in the Andrea Doria class, going up to 13,640 tons in the Re Umberto class, dropping again to 9645 in the St. Bon class, and finally coming up to 13,214 tons in the Benedetto Brin class and 12,625 tons in the Vittorio Emanuele class. Furthermore, Italy has never built more than three battleships of the same class, but varies from one to two, although it is the present intention to build five Vittorio Emanuele's.

Shall the United States, in solving the battleship problem "on a larger scale and for that reason in a more conspicuous manner" follow the example of Italy, or that of our powerful commercial rivals, England and Germany? England has a definite naval policy, her naval architects pay particular attention to the seakeeping qualities of her battleships, and her great wealth has enabled her to build in large classes. With only a few lapses she has steadily progressed from the 9420 tons of the Colossus class (1882) to the 18,000-ton class of the budget for 1903. Germany, handicapped by the shallow waters of the Baltic and the limited width and depth of the Kiel Canal, began with the Sachsen class of 7283 tons and has reached 13,000 tons in the Braunschweig class, while rumor says that the two new battleships of the 1903 program will have still greater displacements. This is evolution pure and simple, each country arriving independently at the same conclusion, which is so aptly expressed by the essayist in his two assertions that "the biggest is the best" and that "the best is the cheapest."

The United States has no established naval policy, no general staff and no definite building program. It is a good sign, however, that Congress is looking into these matters and the Dayton resolution may be the forerunner of better times when the needs of the nation will, to quote the essayist, "bring to the solution of such problems the best genius, highest attainment, and most acknowledged ability of the service." Not until then can we hope to have a navy that will constitute a proper insurance on our national wealth and a sure guarantee of peace.

Attention has been called to the fact that the speed of the Vittorio Emanuele is to be 22 knots as compared to the 18 and 19 knots of most

foreign battleships. In estimating the importance of the factors that go to make up the inevitable compromise in the displacement of battleships, speed has been the subject of much discussion. Strategically the ships that arrive at the theatre of operations "fustest with the mostest guns"—to paraphrase General Forrest's well known principle—will have the advantage. Tactically, if these ships find that by keeping at long range they can maintain a superior gun-fire, speed will enable them to maintain this range and keep the enemy from closing in. As the essayist points out, the Louisiana and Connecticut constitute the first class of battleships yet designed for our service that is really entitled to the denomination *sea-going*, all others, to date, being very properly *coast-line* battleships, not intended for long-continued operations at a distance from our own coast. We must soon decide whether our naval policy shall be to act always on the defensive or whether we may be called upon to follow the strategic principle that the first objective is the enemy's fleet and the tactical corollary that only superior gun power can win naval battles. Other factors remaining the same, it is well to remember that greater speed means greater displacements.

After all, it is the question of cost that most influences the legislator's mind. Financial heresies and false economy are frequently the outcome of party politics. Public opinion may be perfectly rational upon the subject of raising and allotting national revenues, but Congress, changing every two years and divided on party lines, finds great difficulty in satisfying the numerous demands made upon it. The *sectional* spirit generally overcomes the *national* spirit, and not until this is reversed (perhaps the millennium may be near at hand) can we expect to see naval appropriations made a properly proportioned allotment of the nation's total revenues, increasing uniformly with the industrial and commercial progress of the country. Under these conditions the technical talent of the navy can work for fighting efficiency in a homogeneous battle-fleet. First a feast and then a famine; millions poured in under the influence of panic and cheese-paring when the danger was thought to be over—this has been our record in the past. If it be true that the Senate's demand for 13,000-ton battleships was due solely to the question of first cost, the arguments in the present essay clearly show that such a penny-wise pound-foolish policy ought to yield to the principle that in battleship design and construction the best is cheapest.

Asst. Naval Constructor T. G. Roberts, U. S. Navy.—Starting with the premises "The biggest is the best," and "The best is the cheapest," it is not very difficult, indeed, to arrive at the conclusion that the proper battleship to build is the one with the greatest displacement, the greatest gun-power, the greatest armor protection, the greatest freeboard, the greatest horse-power, the greatest coal capacity, the greatest radius of action, the greatest comfort for the crew, and the greatest all the other things in the category; except that, in this case, no particular stress seems to be laid on the greatest speed, although that item might well have been added to make the sum complete. That is to say, reasoning in the abstract, with no

set conditions, the theoretical conclusions reached are sound enough to be on the safe side, without any risk whatever of making a very grave error. The kind of battleship we should build is thus proved to be just like the largest and most improved one projected up to the present. I think the naval service will be in accord on that point, but it appears to me that the practical side of the case will play some part in arriving at a final conclusion. Theoretically, we should build fifty or a hundred battleships, all alike, both larger and better than any others afloat; but practically, it cannot, and will not be done, for many sufficient reasons.

In the first place the suggested general staff could not, under our form of government, have any more *power* to determine the type of ship than the board of construction now has; its functions would be merely advisory to a civilian Secretary of the Navy, whose functions would be advisory to Congress, as now; and there is nothing in human nature to warrant the supposition that Congressmen or a civilian secretary can be induced to yield their power, which is their prestige. It ought to be done, there is no doubt about that, but it must be recognized that the Navy Department, with its multi-bureau system, cannot be supposed to transact business on the lines adopted by the British admiralty.

A general staff, if created, could do only one thing; it could replace the personnel of the "Board on Construction" and the "General Board," combining the two, thereby relieving the bureau chiefs from the advisory functions they are the most capable of fulfilling, and creating such duties for younger, and less experienced men. Whether construction board, general staff or admiralty, it is only a question of terms, the actual power of the British admiralty is not likely to establish itself at the Navy Department.

I am therefore of the opinion that the proposed method of determining type-ships is not practicable, and those who may wish to go further into this question are invited to read an article entitled, "The Launching of a Battleship From the Congressional Ways," by Hon. Wm. McAdoo, published last year in the *North American Review*, wherein it is made very evident that the greatest vicissitudes ever experienced by an American battleship was in Congress before it reached the Navy Department. The service has always agreed that reform is needed, but this reform seems not to be near. With such reform a general staff, or admiralty, or whatever you might call it, would have the absolute power to determine all questions of naval policy independently of political influences; and most important of all, to direct the naval operations during war to the best military advantage, without regard to the clamors of frightened communities, to which civilian influences are too amenable. Without the power, however, the creation of boards and general staffs will be the equivalent of engaging highly educated employees in an old-fashioned establishment.

The essayist has taken issue with the Senate, evidently, because the latter advocated four Oregons in place of three Louisianas, and it seems to me that the Senate must have been inspired by the end of wisdom, that could not have been altogether accidental. The reasons are entirely practical; we need various classes of battleships, we need them in the same

proportions as exists in other countries, we have a small navy and must increase all the lines as we go, and we need numbers of smaller ones in preference to a few very large ones, until we catch up. Why should Chili build a 16,000-ton battleship, should she determine suddenly to build a great navy? Let us go through the high school before we go to the university. We will not be ready to destroy England the day after to-morrow. We need one Louisiana to two Maines, and three Oregons. No navy consists only of big battleships and admirals; all the numbers and all the grades should be added along as we grow; and preference is greatly in favor of filling up the lower grades first. This is the true basis of comparison, and the personal element should not be lost sight of in comparing the chances of 80 improved Oregons pitted in battle against 60 Louisianas.

John Paul Jones, in the Bonne Homme Richard, a one decker in reality, prevailed over the Serapis, a two decker, by virtue of the personal quality of persistent and tenacious courage, alone, which counted for more than a whole deck of guns in the final issue; and I think the sum total of human experience in naval warfare may be gauged by the same measure. I would rather command one Victory than one Santissima Trinidad, including the personal element. A ship-of-the-line has always counted as a ship-of-the-line, and the fleet with the greatest number of vessels has been counted the strongest, less consequence being laid on the difference between two, three, and four deckers, or a small difference in displacement. I do not mean to compare modern to obsolete vessels and conditions, for the pencil-and-paper comparisons would not strictly justify it; but it can be said by all the experience of the past that a difference of 3000 tons between the new Mississippi and the Louisiana would not decide the battle by any means whatever. Much less so, since the thickness of armor may be made the same on one as on the other.

To go to the point, I think we ought to gauge the number of our battleships of each displacement in proportion to the numbers that exist in the British navy, and we ought to turn them out ten alike at a time; with the rapid developments of shipbuilding, we cannot hope to build vessels this year, with no improvements over those of last year.

The above seem to me the main considerations that should guide our policy, and the absence of technical questions is made plain, for, having them in mind, I do not think they merit any special consideration.

I trust the essayist will pardon me, however, if I refer to certain technical points of his arguments in order to establish my views. There is nothing vital in the name *coast-line* battleship; that does not mean that the vessel is lacking in seaworthiness or in stability, for the contrary is the case. The only disadvantage of the low freeboard is the personal one mentioned in the paper, and is most likely reviled by the commanding officer, because of the spray and water coming on deck in heavy weather; but its advantage should come in handy in presenting a smaller target in action. It, thus, has some of the qualifications of a monitor, and omits a large surface that would otherwise require armor to cover it. Such is the Oregon, and she is sufficiently seaworthy to be safe. I do not mean to say that a higher freeboard is not necessary when a larger crew is to be

housed, and more guns provided, but it is certainly questionable whether the lower freeboard will not be preferable in action, if the principle of the monitor is worth anything. We have no positive proofs to decide this question, so I merely wish to emphasize the fact that all the arguments are not on one side, and that the Oregon class are still useful. As this discussion is to develop a fixed policy, I will record my opinion that ten vessels should have a high freeboard, and ten a low freeboard, until the result of a battle should indicate the superior. Except for the question of target, the higher freeboard is certainly the more preferable, but the target question is of vital consideration, while the high freeboard is not.

The statement that it took 1000 tons to give the Iowa a higher freeboard, and 2 knots greater speed, than the Indiana, is subject perhaps to further qualification in that the 2 knots speed must account for most of the increase in tonnage, in view of materially increased horse-power, engines, boilers, and auxiliaries, aside from the necessity of greater displacement for greater speed, with similar lines.

Another question seems to be raised in the statements "that we have reached a trial displacement of 16,000 tons which will mean a deep load displacement of 18,000," and "that the battleship of the future should not displace less than 18,000 tons on full load." I understand that all these terms simply apply to the Louisiana type, or is it that a still larger ship is meant? If the largest is the best, why not make it 25,000 tons?

The truth of the matter is that power is only relative. France built steel ships and the others followed suit; one country built submarines and the others did likewise; and so with guns, and armor, and torpedo-boats, and battleships, and nearly all the details therein. England, strange as it may sound, is our real rival, and we must follow the rational plan of building vessels of similar displacement to her various classes, but in greater numbers, and more perfected in details, if possible. I cannot imagine all future U. S. battleships 16,000 tons and over, it would be such a departure from history, and from the actual needs.

It is not yet evident that the Louisiana will not exceed her designed load draft by as much as the Oregon class; nor is it proved that the questions of *handiness, draft,* and *docking* of the large vessels, determine fully the question of best size. But with the question of cost, that is a different matter which we in the navy often hear of, and wonder about, but seldom approach.

If a large floating machine shop is run by the spar-scaling salt of "ye olden tyme," that is, by unskilled labor, where the main object is to keep all hands happy by keeping them busy, what will be the profit and loss? I only mean to say that we are more reasonable in granting that the cost of a big ship is of minor consideration, than are the Congressmen who determine this all-important question, which is the real stumbling-block in our pathway towards self-protection that we will need before long.

Finally, I note the language, "If this class (Oregon) is ever rebuilt, and it is to be hoped that it will be," and seeing thereby that the essayist is not strictly pledged either to the large or the small battleship, but rather to both in their proper places, I realize that we are in accord, so there is no need of further argument.

Naval Constructor HORATIO G. GILLMOR, U. S. Navy.—The subject treated is one of very great importance to the navy, and is presented in the usual forceful manner of the author. While one may not agree fully with all that the author presents, one is compelled to admit that in the main his presentation is broad and his deductions logical.

The question of speed of battleships, as of other ships, is one upon which there has never been a full agreement among technical or lay men, so that, unfortunately, we have no absolute standard from which the absolute minimum requirements as to speed for battleships may be judged. In the providing of battleships, a nation is in very much the position of a business house in competition with other business houses engaged in the same pursuit. The business methods of one must be considered by the others and competition met in its own way. We know that the principal foreign naval powers are arranging for high speeds in their battleships, and for that reason, we assume that it is necessary, if we are to sucessfully meet them, that our vessels shall be given correspondingly high speeds.

If, however, the other defensive and offensive features of a battleship are to be developed to such an extent as to make her capable of receiving severe punishment from an enemy without disablement, and, at the same time, capable of inflicting equal or greater punishment on vessels within the same range, it is questionable whether the necessity for the speeds for which battleships are at present designed are absolutely necessary. We know that by a reduction of two knots from the speed requirements, there can be produced a very powerful battleship upon a moderate displacement, presenting a correspondingly smaller target to an enemy.

"OUR TORPEDO-BOAT FLOTILLA." See No. 105.

Lieutenant R. H. JACKSON, U. S. Navy.—The thanks of the service are due to the writer who has carefully collected the data embracing the operations of torpedo craft since their early history, and the conclusion of experts founded upon them. He also gives us information upon the course of training developed by the experiences of foreign services. With this information at hand we can compare and develop our system as best suits our needs.

Coming, then, to the objective of the writer "How best to accomplish the training of the greatest number of officers and men to efficient torpedo work, so that at any time the entire flotilla may be mobilized on a war basis," I submit the following scheme as an amplification of the present system, applicable at once, when the scarcity of officers and men make a long and thorough course impracticable for a large number.

To mobilize on July 1st annually a flotilla of four sections, one of destroyers and three of torpedo-boats. This flotilla to be kept together for three months and then the three torpedo-boat sections to be returned to reserve; the destroyer section to remain permanently in commission, and to form the nucleus of officers and men for the annual mobilization.

The destroyers during the winter drills should carry three officers; then in the spring the two junior officers to be sent as commanding officers of

the torpedo-boats as fast as they could be taken out of reserve, the total number of commanding officers needed being filled out from officers on boats in reserve, or that have applied for torpedo-boats.

On July 1st the graduated class of midshipmen then on leave to be ordered to all boats and destroyers, one for each boat and two for each destroyer. This would take about fifty midshipmen. The academic board should furnish the Department with a list of those midshipmen that it considered best qualified to serve; the remainder of the class to be sent to the school at Newport for a six weeks' course, and then sent to battleships as a possible reserve for the detail the following year, if on the station. When the sections were placed in reserve in the fall the midshipmen then on board to be sent to the North Atlantic Station, preferably to the battleships, for a six months' winter cruise.

When the midshipmen from the Newport school arrived on the battleships this would allow a class to be made up from the junior officers on board to take a six weeks' course till October 1st.

To provide the crews one-half of the destroyer section would be detailed as a nucleus to the boats, and additional men to be drawn from the general service; if necessary placing in reserve gunboats and monitors, or a large cruiser. By arranging to have the Newport classes finish their course in June, and arranging to have a vessel go out of commission about that time, the men could probably be obtained. When the boats again went into reserve, selected men of the crews to be allowed to remain on the boats going in reserve. This general plan seems practical, the detail being modified somewhat each year to meet circumstances.

The training given to officers and men would be simply invaluable. It requires that the commanding officer become thoroughly conversant with his boat, both in the engine room and on deck. The midshipmen would come there well acquainted with the theory of their profession, eager to learn, with studious habits, and at once be given an opportunity to apply practically their knowledge in such manner as to see immediate results and to feel the responsibility of their position. When they are piloting a boat, adjusting and running a torpedo, or running an engine, they feel that they are accomplishing something, and making rapid strides toward perfecting themselves as naval officers. On the large ships the midshipmen having little or no responsibility are apt to devote themselves principally to having a good time. It is time when a young man is 23 or 24 years that he should be allowed to share in some of the responsibilities of his profession.

Of course the objection urged against this plan is that an inexperienced officer is put in a position of responsibility; but the officer must make the plunge some time, and age alone will not remedy, but rather accentuate his difficulties; moreover, his knowledge is fresher and his mind more receptive than it will ever be again. On the destroyers with the commanding officer and the crew both well trained, and every thing in working order surely this can be done. On the torpedo-boat the midshipmen would practically, under the commanding officer as his assistant, both on deck and in the engine room.

While on the subject of the training of officers I would like to add one word. I am a firm believer in the amalgamation scheme. But to insure its efficiency there must be no let-up in the severity of the examinations for promotion. The Academy does its work well; and if the examinations for ensign, junior lieutenant, and lieutenant be made progressive and comprehensive there is no doubt that the high standard required will surely be maintained. The knowledge that such requirements will be exacted is the most powerful incentive to diligence and professional application, and holding up a single laggard must of necessity have an excellent effect. To assume that every officer will give his best efforts to his profession for pure love of it, with no system of rewards and punishments, would be to show ignorance of human nature. Our service is one with a minimum of rewards and punishments. Its salvation and its excellence are due to the system of selection which commences with the competitive examination in the congressional district, and ceases with the commissioning of the midshipmen. During this period the system of rewards and punishments holds full control under equal conditions for all.

Such conditions could no longer be simulated after the officer is commissioned, nor is the writer an advocate of further selection on account of the dangers of injustice that might arise. The only selection then desirable would be to select out, or, to put it more frankly, to weed out any that later fell below the standard. So having achieved a high standard let it be maintained. The need for officers can never be so great that we can accept inferior ones. With thorough and comprehensive examinations at the end of 2, 5 and 7 years (which is an approximation of the intervals of promotion) this ought surely to be maintained. The next examination, for lieutenant-commander, to be of two kinds; one making steam-engineering and designing a specialty for officers having indicated a preference for that branch, the other to embrace the executive and organization duties now required. I believe Lieut.-Commander Huse's scheme of division in the lieutenant-commander's grade will work well. The only practical point yet unsolved is whether there is sufficient inducement for officers to sacrifice their desire for command for other advantages, such as additional shore duty in the commander's grade, etc.

But let us start our young officers in the serious business of their profession and keep them at it and there will be no personnel problem to solve.

PROFESSIONAL NOTES.

Prepared by Professor PHILIP R. ALGER, U. S. Navy.

SHIPS OF WAR, BUDGETS AND PERSONNEL.

ARGENTINA.

VESSELS BUILDING.

Name.	Displacement.	Where Building.	Remarks.
Armored Cruisers.			
Rivadavia	7,600	Genoa.	Launched Oct., 1902.
Moreno	7,600	"	Launched Feb. 9, 1903.

The armored cruiser Moreno that has just been launched from the building yards of Messrs. Ansaldo, at Sestri Ponente, near Genoa, for the Argentine navy, is a sister ship to the Rivadavia, launched from the same yard last October, and which so far holds the record for quick work, having been laid down only on March 10, 1902, and launched within seven months, whilst at the same time the second vessel had also to be pushed forward.

These two vessels belong to the far-famed Garibaldi class, of which type four ships have already been completed from the same yard, namely:—Garibaldi, Argentine navy, with cylindrical boilers. Cristobal Colon, Spanish navy, with Niclausse boilers. Pueyrredon, Argentine navy, with Belleville boilers. Giuseppe Garibaldi, Italian navy, with Niclausse boilers. But many improvements have been made on the original type, especially in the armament and its fittings, in the means of supplying ammunition to the different pieces, in the electric arrangements and production, &c. The principal dimensions of the vessel are as follows:—Length, extreme 108.86 m. (357 feet, 2 inches); length between perpendiculars 104.86 m. (344 feet); width over armor 18.70 m. (61 feet, 4 inches); mean draught 7.30 m. (24 feet); displacement in metric tons 7700 m. (7583 tons).

The armorplates are hard-faced by the latest process and furnished by the Terni steel works. There is a central armored redoubt which extends for about half the length of the ship, the belt being 150 millimeters (5.9 inches) thick at the sides, and the athwartship plates 120 millimeters (4.7 inches) thick. Outside the redoubt there is a belt extending 1½ meters above and below the water-line, of a thickness commencing with 150 millimeters (5.9 inches) and diminishing to 80 millimeters (3.1 inch) at the extreme ends. The armored deck over the redoubt is formed of two plates with a total thickness of 40 millimeters (1.6 inches), and beyond this is of 20 millimeters thickness to the extreme ends.

The armament is as follows: Four quick-firing 8-inch guns in the two barbettes fore and aft; ten quick-firing 6-inch guns in the main battery; four quick-firing 6-inch guns on the upper deck; four quick-firing 3-inch guns at the ends of the main battery; six quick-firing 3-inch guns on the upper deck; two Maxims in the fighting tops; two 3-inch guns for land use.

And there are also four torpedo tubes for above water discharge in armored casements. There are two main magazines situate directly under the fore and aft barbettes, and four for the secondary armament, two being in the center of the vessel, one forward, and one aft.

The electric plant is considerably more powerful than has hitherto been fitted in vessels of this class, and is divided into two portions, three large dynamos being placed forward under the armored deck, and two others for general use on the upper deck amidships. The electric current furnished by these is used for general lighting and searchlight purposes, for the training gear of the guns, for the night sights, for firing the guns, for the ammunition hoists, for furnishing power to the workshop tools, the ventilating fans, the ash-hoists, the air-compressors, and for speed and direction indicators from the engine-rooms.

The propelling machinery is of 14,000 indicated horsepower, and has been constructed at Messrs. Ansaldo's works at Sampierdarena. It should give the vessel a speed of over 20 knots.

The coal capacity is about 1100 tons, and the radius of action at 10 knots speed is about 9000 miles.

After the launch the Moreno was towed to Genoa, and moored alongside her sistership the Rivadavia and the Turkish battleship Messoudjet, which has been recently reconstructed and rearmed by Messrs. Ansaldo, and is now waiting orders to leave for Constantinople.

The completion of the vessel is to be pushed forward with all speed, and if these two ships are incorporated in the Argentine navy, they, with their sister vessels, will form a very formidable fighting unit, as there will be a squadron of six vessels, composed of the Garibaldi, General St. Martino, General Belgrano, Pueyrredon, and the present two vessels in construction the Rivadavia and Moreno, all of the same class and approximately the same speed and armament.—*Engineering*, Apr. 10, 1903.

AUSTRIA.

VESSELS BUILDING.

Name.	Displacement.	Where Building.	Remarks.
Battleships.			
A (ersatz-Laudon)	10,600	Trieste.	Building.
B (ersatz-Drache)	10,600	"	"
C	10,600	"	To be laid down 1903.
Babenburg	8,340	Pola.	Launched Oct., 1902.
Armored Cruiser.			
E (ersatz-Radetsky)	7,400	Pola.	Building.
River Monitors.			
Save	450	Neupesth.	Nearly ready to be launched.
Theiss	450	"	" " " "

The battleship Arpad had her official trial on April 7th, and gave a maximum speed of 20.12 knots and a mean speed for 6 hours of 19.65 knots. She is the second of the three battleships of which the first, the Habsburg, is in service, and the third, the Babenburg, launched last October, is nearing completion.

CHILI.

VESSELS BUILDING.

Name.	Displacement.	Where Building.	Remarks.
Battleships.			
Libertad	11,800	Barrow.	Launched Jan. 15, 1903.
Constitucion	11,800	Elswick.	Launched Jan. 13, 1903.

CHINA.

The two new Chinese torpedo gunboats Kien-Wei and Kien-Ngan were wholly constructed in the Fanchan arsenal on the plans of the French Engineer-in-Chief Dayere who, with his government's permission, is directing that arsenal. They are twin-screw boats of 875 tons displacement with a maximum draft of 10 feet 8 inches, and have a speed of from 22½

to 23 knots. Their propelling machinery is identical with that of the French gunboats Dunois and Lahise and was furnished by the Forges et Chantiers de la Méditerranée. Their armament consists of one 10-cm., three 65-mm. and six 37-mm. rapid fire guns, all on the Canet system, and two torpedo tubes.

FRANCE.

VESSELS BUILDING.

Name.	Displacement.	Where Building.	Remarks.
Battleships.			
République	14,865	Brest.	Launched Sept., 1902.
Démocratie	14,865	"	Building.
Patrie	14,865	La Seyne.	"
Justice	14,865	"	Ordered.
Vérité	14,865	Bordeaux.	"
Liberté	14,865	St. Nazaire.	"
Suffren	12,728	....	Under trial.
Henry IV	8,949	....	" "
Armored Cruisers.			
Ernest Renan	13,562	Brest.	Ordered.
Jules Michelet	12,550	Lorient.	"
Jules Ferry	12,550	Cherbourg.	Building.
Victor Hugo	12,550	Lorient.	"
Léon Gambetta	12,550	Brest.	Lchd. Oct., 1901; com. 1903.
Jeanne d'Arc	11,270	....	Trials just completed.
Gloire	10,014	Lorient.	Lchd. 1900; complete 1903.
Amiral Aube	10,014	St. Nazaire.	Under trial.
Sully	10,014	La Seyne.	" "
Condé	10,014	Lorient.	Lchd. March, 1902; com. 1903.
Gueydan	9,516	....	Under trial.
Dupetit Thouars	9,516	Toulon.	Lchd. July, 1901; com. 1903.
Desaix	7,700	....	Under trial.
Dupleix	7,700	....	" "
Kléber	7,700	....	" "
Torpedo Boat Destroyers.			
Escopette	303	....	Under trial.
Flamberge	303	Rochefort.	" "
Espingole	303	....	" "
Sarbacane	303	Rochefort.	Launched.
Carabine	303	"	"
Francisque	303	"	"
Sabre	303	"	"
Arquebuse	303	....	Under trial.
Arbalète	303	Havre.	Launched.
Mousquet	303	....	Under trial.
Epieu	303	Havre	" "
Fronde	303	....	" "
Javeline	303	....	" "
Bombarde	303	Havre.	Building.
Catapulte	303	"	Launched.
Dard	303	Rouen.	"
Balliste	303	"	"
Mousqueton	303	Chalons.	Ordered.
Arc	303	"	"
Pistolet	303	Nantes.	Launched.
Bélier	303	"	"
M_{11}	?	Rochefort.	"
M_{12}	?	"	"

The new French first-class armored cruiser Amiral Aube left St. Nazaire, where she was built, for Cherbourg on the 9th inst. for her delivery trials, at which her engines must develop and maintain for 3 hours 18,000 H. P. at least. The contract power is 20,500 H. P., and a penalty of 200 francs (£8) has to be paid by her builders for every H. P. below that; while if the power developed falls below 18,000, the minister of marine has the right to refuse the ship. For the 3 hours' full-speed trial the consumption of coal per hour per square meter (10.76 square feet) of grate surface must not exceed 170 kg. (374.67 lbs.), under a penalty of 1000 francs (£40) for every kilogram (2.204 lbs.) above 170 kg. (374.67 lbs.). The ship may also be rejected if the coal consumption exceeds 185 kg. (407.74 lbs.) in order to obtain the required power. The engines are to develop at her 24 hours' trial under natural draught, at least 10,000 H. P., with a coal consumption of from 750 gr. (1.5 lbs.) to 800 gr. (1.6 lbs.) per H. P. per hour, and a premium or fine of 200 francs per gramme, according as the coal consumption is below or exceeds the contract. Finally, the ship is to run for six hours, working all three engines, which are to develop 14,000 H. P., with the same rate of coal consumption as in the 24 hours' trial, and she has also to make a run of 6 hours' duration at 1,800 H. P. only, the coal-consumption being at a rate of between 650 gr. (1.3 lbs.) and 700 gr. (1.4 lbs.) per H. P. per hour, and the number of engines and boilers used being left to the discretion of the builders. The Amiral Aube is a sister ship to the Marseillaise.

THE NEW BATTLESHIPS.—The *Yacht* is jubilant that the good sense of the budget committee has triumphed over the inexplicable resistance of the often badly-advised minister of marine, and that the remaining five battleships of the République type are at last to be proceeded with. In the opinion of that journal, M. de Lanessan, M. Pelletan's predecessor, is the only civilian minister of marine in recent years who has really understood the needs of the fleet, and who thought out the programme of new constructions from a broad point of view, so it was all the more to be regretted that the execution of his programme was so soon suspended. The country and navy are to be congratulated that the budget committee, and in especial the reporter, M. H. Leygue, have had patriotic firmness enough to overrule the minister of marine, and to insist that the scheme evolved by M. de Lanessan should be carried out.

Of the new ships, Démocratie, like the République, will be built at Brest; the Liberté at St. Nazaire; the Vérité at Bordeaux, and the Justice and Patrie at La Seyne, near Toulon. The dimensions of the ships will be as follows:—Length, 439 feet; beam, 79.5 feet; displacement, 15,000 tons, with a draught of 27 feet 4 inches. The immersed surface of the midships section will be 179.75-m.; displacement by centimeter of immersion above the load water-line, 22.6 tons; height of latitudinal métacenter above the centre of the hull: $P = 5.36$-m.; height of latitudinal métacenter above the centre of gravity: $P - a = 1.1$ about. Normal I. H. P. about 10,500; maximum I. H. P. 18,000, giving a speed of about 18 knots; this is 500 H. P. more in the five new ships than the République has, involving an increase in the cost of the machinery of 150,000 francs (£6,000); the machinery for the République is to cost 2,350,000 francs (£94,000); and that for the new vessels 2,500,000 francs (£100,000). The types of water-tube boilers selected for the new ships are the Belleville and the Niclausse, but it is not settled which ships are to have the respective boilers. The coal supply will be 1800 tons, which should give a radius of action at 10 knots of 8300 miles. There will be no steel keel, but a false keel of teak, and bilge keels.

Protection will be afforded by a steel belt, extending from the stern aft to frame No. 108, where there will be a transverse bulkhead 8 inches thick; the belt will extend from 7 feet 6 inches above to 4 feet 10 inches below the

water amidships, with a maximum thickness of 11 inches, tapering above to 9.4 inches at its upper edge, and to 4 inches at the lower; from frame No. 28 to the stem the belt will be 7.2 inches thick at the water-line, tapering to 5.4 inches at the upper edge to 3.2 inches at the lower, and reaching from 8 feet 3 inches above the water-line to 9 feet 9 inches below; the after part of the belt similarly tapers to 7 feet 6 inches above and 3 feet 2 inches below the water-line: the teak backing will be 3.14 inches thick, and the inner plating 0.78 inch.

The armament will consist of four 12-inch guns in turrets, one forward and one aft; eighteen 6.4-inch Q. F. guns, twelve of which will be mounted in couples in small turrets, three on each side of the upper deck, the remaining six guns being mounted in a casemate amidships on the main deck, three on each side; twenty-four 3-pounder Q. F. guns, and five torpedo tubes, two of them submerged. The bases of the heavy turrets will be protected by 12.8-inch armor, the turrets having 11-inch armor on the fore side, with 8-inch armor in rear of the fore turret, and 4-inch on the after; the hoods will be of 3-inch steel. The turrets and casemate for the 6.4-inch Q. F. guns will be protected by 6.3-inch plating, the hoods of the former being of 1.7-inch steel, and the splinter bulkheads in the latter of 4-inch steel.

The *Yacht* considers that the new ships are quite equal, if not superior, to any battleships now building for foreign powers, but remarks that in the matter of speed it is difficult to believe that the 18,000 I. H. P. of the King Edward VII class will give them a speed of 18 knots, or that the Venerable or London of 15,000 tons displacement, have made 18.3 knots and 18.1 knots respectively with engines only developing 15,345 I. H. P. in the first named ship, and 15,265 I. H. P. in the latter, if it is necessary, in the case of the French ships in order to obtain 18 knots, to have engines developing 17,500 and 18,000 I. H. P.; if the English ships really do obtain the speed with which they are credited, then there must be something wrong about the form of hulls of the French ships, and this the *Yacht* refuses to believe.

The latest type of French destroyers, although of increased power and speed, carry only two single-ended water-tube boilers. In the Arquebuse, which has just been delivered at Cherbourg by Messrs. Augustin Normand and Co., and in a number of similar destroyers, the two boilers are of the Normand type. The speed trials, which took place after the ordinary eight-hours' consumption trials and the preliminary runs on the measured mile, were of six hours' duration, one hour of which was at or above 24 knots, one hour at full speed, and the remaining four hours at or above 24 knots. In the one hour at full speed 30.75 knots were attained, with 320.38 revolutions and 7100 indicated horsepower, so that each boiler furnished the steam necessary for 3550 indicated horsepower. This the makers believe to be a record for power from one single-ended boiler. No difficulty was experienced in keeping the pressure. The weight of each boiler complete, with fittings, chimney, ash-pit, fire-bars, and insulating covering, amounts to 19.2 tons without water, and to 22.7 tons with water. The total displacement on trial was 299 English tons, including a deadweight of 68 tons, exclusive of chains, anchors, masts, boats, steam windlass, lighting and steering machinery, torpedoes and torpedo-tubes, compressing pumps, artillery and ammunition, water for boilers and crew, coal necessary for steaming 1170 nautical miles at 14 knots, which was 25.02 tons as determined by the eight hous' preliminary trial, and 9 tons for sundries.—*Engineering*, April 24.

On April 11, the new destroyer l'Epieu in a full power trial gave the greatest speed yet attained by a French vessel: 31.21 knots.—*Le Yacht.*

The French Admiralty have decided upon the construction of a new submarine boat which will exceed in dimensions and displacement any yet attempted. Hitherto the largest submarine in that navy has been the

Gustave Zédé of 266 tons, but this new vessel is to be of 350 tons. It will measure 160 feet 7 inches in length by approximately 9 feet draught. The boat will be driven by a single screw, and will have a surface speed of 11 knots. The torpedo armament will comprise four tubes. It is estimated that the cost of this vessel will amount to $250,000, which is about a third more than the cost of the most expensive submarine yet built for the French navy. It is intended to be an offensive arm, being sufficiently large to attack an enemy's ports, and to cruise along the commercial routes.—*Scientific American*, March 14.

The *Yacht* illustrates the new armored cruiser Sully, built at La Seyne, which is just about to begin her trials at Toulon. She is a slightly improved Montcalm, with a displacement of 10,014 tons and the intended speed of 21 knots. In comparing her with the Kent and the German Prinz Adalbert, the *Yacht* remarks that the greater speed is with the British cruiser, the better armament with the German, and the superior protection with the French. "If we consider these three cruisers after a few minutes' fighting among themselves, it must be admitted, regarding the unprotected guns as out of action, that the Sully would be able to use only ten of her larger guns, while the Kent would still have twelve and the Prinz Adalbert fourteen. Taking into account, however, the differences of caliber, the Sully would still be almost equal to the Kent, while the German cruiser would surpass both." Generally speaking, the *Yacht* believes that the French cruiser would have nothing to fear in comparison with similar foreign vessels, and if the three cruisers named be examined closely, she would be given the first place because of her excellent protection. The *Yacht*, however, would give her two additional 6.4-inch guns, economizing the weight by taking out certain of her 3.9-inch guns and a part of her torpedo equipment.—*Army and Navy Gazette.*

The Sully's armament consists of two 19.44 cm. guns in turrets on the middle line; eight 16.47 cm. R. F. guns, of which four are in turrets and four in casemates: six 10 cm. R. F. guns; eighteen 47 mm. and four 37 mm. She also has five torpedo tubes, of which two are under water.

THE BOILER QUESTION.—Some uneasiness is reported to exist in naval circles in view of the large number of ships which require re-boilering at the present time. At Toulon alone the battleships Magenta, Carnot, Brennus, and Caïman; the armored cruisers Latouche-Tréville, Chanzy, and Charner; the second-class cruisers Descartes, Cécille, Du Chayla, Cassard, Alger, and Bugeaud; the third-class cruisers Linois, Condor, Cosmao, and Wattignies; and the destroyers Lévrier, Faucon, D'Iberville, Casabianca, Léger, Dague, and Dunois, are all waiting to be taken in hand. In view of the difficulties which have been experienced with the small-tube boilers of the Guyot type in the Jeanne d'Arç, Châteaurenault, and Jurien de la Gravière, it seems certain that no more small-tubed boilers will at least be fitted in large ships, while it also seems to be settled that the economizers will not be fitted in the future to the Bellevilles. A committee of engineer officers which has been sitting in Paris in connection with the boiler question, has reported to the effect that the small-tube boilers add greatly to the fatigue of the stokers, that in the newest types the rate of combustion is so excessive that they soon become choked, with the result that the steam pressure is lowered, speed decreased, and coal consumption increased in inverse ratio; they attribute these defects to insufficient heating surface in the boilers, which are consequently more difficult to keep in good repair, and deteriorate more rapidly. The committee point out that in the case of the so-called commerce-destroyer Châteaurenault, which was supposed to be able to steam from Toulon to Saigon, or at least Singapore, without re-coaling, she only got as far as Colombo, and there had to re-fill her bunkers. They further draw attention to the difficulties which have been experienced in so many cases recently in

getting ships successfully through the full-speed trial, although this only lasts for three hours, while no such difficulties seem to be experienced in foreign navies, although in England the full-speed trial is for eight hours, and in the United States and Russia for twelve hours, sometimes longer.

The large-tube boilers of the Belleville and Niclausse types will allow of larger grate surface, while the increased weight will be compensated for by greater economy in steaming, for the radius of action of a ship depends not alone upon the amount of coal she carries, but also upon the consumption. It is recommended that the full-speed trials of ships should be made for three hours with a coal consumption of 110 kg. (242.4 lbs. per square meter of grate surface, and a second trial of three hours with three-fourths of the boilers with a consumption of 150 kg. (330.6 lbs.).—*Le Yacht, Le Temps,* and *Le Petite Var.*

The French coast defense organization has for some time been unsatisfactory, and the distribution of duties and responsibilities has pleased no one. It has lately been decided that the ministry of war shall delegate to the naval prefects at the five ports the command of the artillery in all batteries facing the sea. According to law, the war ministry is responsible for the defense of national territory, while to the navy falls the task of protecting the coast from the sea. It is, however, impossible for the work of the two departments not to overlap. The question of securing unity in the command arose, and it being considered an advantage that the shore guns should be in the hands of those who know ships, and are practical naval gunners, seemed to point to the fact that the navy should be responsible for the shore gunnery work also. At any rate, it was this consideration that forced itself upon the government, and thus it happened that the Superior Council of War and the War Department were disposed to delegate part of their power to the ministry of marine. There are still various views as to the merits of the arrangements, but they are generally regarded as satisfactory. The result is to add to the importance and responsibility of the naval prefects. As is well known, the whole coast is divided into five arrondissements assigned to the several ports, each arrondissement being subdivided for the administration of the Inscription Maritime.—*Army and Navy Gazette.*

EXERCISES WITH SUBMARINES.—On 12th April, two submergible boats, the Espadon and Silure, made attacks on the trans-Atlantic liners Brétagne and Champagne, whose commanders had previously been warned to be on the lookout for and avoid submarine vessels.

The Espadon awaited the passing of the Brétagne outward bound to America, off Barfleur, and as soon as the liner was observed submerged herself. The Brétagne did not alter her course, not having observed the Espadon, which rose to the surface barely 200 yards from the liner, amid much enthusiasm from the passengers.

The Silure, which was waiting off La Hogue, did better still. When the Champagne was observed on the horizon, homeward bound from New York, it was decided to attempt to torpedo both the liners simultaneously. A dive was accordingly made, and the Silure so maneuvered as to place herself between the two mail steamers at the moment of their passing each other, and while the latter were engaged dipping their ensigns, the Silure, much to the astonishment of those on board, arose between them, displaying her ensign also.

GERMANY.

VESSELS BUILDING.

Name.	Displacement.	Where Building.	Remarks.
Battleships.			
Wittelsbach.....	11,900	Wilhelmshavn.	Completed.
Wettin.....	11,900	Dantzic.	"
Ziaringen.....	11,900	Kiel.	"

VESSELS BUILDING.—*Continued.*

Name.	Displacement.	Where Building.	Remarks.
Mecklenburg	11,900	Stettin.	Under trial.
Schwaben	11,900	Wilhelmshavn.	Lchd. Aug., 1901; compl. 1903.
Braunschweig	13,200	Kiel.	Lchd; complete in 1904.
Elsass	13,200	Dantzic.	Building; " "
K	13,200	Stettin.	" To be compl. 1903.
L	13,200	Kiel.	" " " "
Lothringin	13,300	Dantzic.	"
N	13,200	Gaarden.	Building.
Armored Cruisers.			
Prinz Heinrich	8,868	Kiel.	Under trial.
Prinz Adalbert	9,050	"	" "
Prinz Friedrich Karl	9,050	Hamburg.	Launched June, 1902.
D (Ersatz Kaiser)	9,050	Kiel.	Building; complete 1903.
E (" Deutschland)	9,050	Hamburg.	" " "
F	9,050	Kiel.	" " "
Protected Cruisers.			
Frauenlob	2,715	Bremen.	Lchd. Mar., 1902; compl. 1903.
Arcona	2,715	"	Lchd. Apr., 1902; compl. 1903.
Undine	2,715	Kiel.	Lchd. Dec., 1902; compl. 1903.
K	2,715	Stettin.	Building; complete 1904.
L	2,715	Bremen.	" " "
M (Ersatz Zieten)	2,715	"	" " "
Gunboats.			
Panther	977	Dantzic.	Launched April, 1901.
B	977	Stettin.	Building.
Torpedo Boat Destroyers.			
108 to 113 (6 boats)	350	Kiel.	All lchd. (4 completed trials).
114 to 119 (6 boats)	350	Elbing.	Building (2 launched).
120 to 125 (6 boats)	350	Dantzic (Schichau).	Building.

Rapid progress is being made, says *Ueberall*, with the German battleship Schwaben at Wilhelmshavn. The twelve boilers and three machines are in place as well as the after funnel, and recently the forward funnel was hoisted in by the floating crane. Preparations are being made to fit the boat cranes, which are quite ready. The guns will soon be in position, and it is expected that the ship will be ready in November.

The battleship M was begun at Dantzic on March 31 last; like battleships J and K, she is of the same type as the Braunschweig, but her armor will be slightly thicker, being 280 mm. on the turrets instead of 254 mm. All these ships will be armed with the new 28 cm. rapid firing guns, which with a charge of 68 kilos and a projectile of 270 kilos have a muzzle velocity of 15 meters. It is said that the battleship N, to be built at Kiel, will be of an improved type.

The First Squadron of the German navy, under the command of Prince Henry of Prussia, is starting on a four weeks' training cruise. The squadron will be composed of the battleships the Kaiser Friedrich III, Kaiser Wilhelm II, Kaiser Wilhelm der Grosse, Kaiser Karl der Grosse, Kaiser Barbarossa, Wittelsbach, Zaehringen, and Wettin; the two armored cruisers the Prinz Heinrich and Victoria Luise; and four protected cruisers, the Amazone, Ariadne, Medusa, and Frauenlob. During the voyage to the Portuguese coast, which is to be reached on May 17, operations of different kinds will be practiced. It is possible that the smaller cruisers may steam up the Tagus and visit Lisbon. On May 22 and 23 the squadron will coal under war conditions from eight steamers, which will be in readiness at Vigo. Dover will be reached on June 2, and on the return voyage maneuvers will be carried out in Danish waters. The

cruise will conclude with an attack on the fortifications of Kiel. It is pointed out that the German Empire has never been able before to send a squadron of 14 vessels of the newest types, with a total complement of 7000 men, for a four weeks' cruise in the Atlantic.—*Army and Navy Gazette*, May 9.

According to the official statistics submitted to the Reichstag, the total number of cadets, etc., and seamen trained in the German navy since 1879 is 147,000. After deducting 25 per cent from this number for losses through death and disease, it is estimated that there remain 110,000 trained seamen, who would be called upon in time of war. Of these, 36,000 men are at present in active service.

The German fleet by the latest laws is fixed at 38 battleships, 14 large and 38 small cruisers; 31 battleships (12,000-14,000 tons), 11 large cruisers, and 32 small cruisers are already in service or nearing completion.

GREAT BRITAIN.

VESSELS BUILDING.

Name.	Displacement.	Where Building.	Remarks.
Battleships.			
A	18,000	To be laid down this year.	
B	18,000	" " " " "	
C	18,000	" " " " "	
Hindostan	16,350	Clydebank.	Building.
New Zealand	16,350	Portsmouth.	"
Commonwealth	16,350	Glasgow.	Launched May 13.
Dominion	16,350	London.	To be launched in Aug.
King Edward VII	16,350	Devonport.	Building. Will be lchd. July 22.
Queen	15,000	"	Launched March, 1902.
Prince of Wales	15,000	Chatham.	" May, 1902.
Armored Cruisers.			
Duke of Edinburg	13,500	Pembroke.	Building.
Black Prince	13,500	Blackwall.	"
3	13,500	Pembroke.	Ordered.
4	13,500	.....	Projected.
5	13,500	.....	"
6	13,500	.....	"
Hampshire	10,700	Elswick.	Building.
Devonshire	10,700	Chatham.	"
Roxbury	10,700	Glasgow.	"
Asgrim	10,700	Clydebank.	"
Argyll	10,700	Greenock.	"
Carnarvon	10,700	Glasgow.	"
Essex	9,800	Pembroke.	Under trial.
Kent	9,800	Portsmouth.	"
Monmouth	9,800	Govan { London & Glasgow Co.	"
Cornwall	9,800	Pembroke.	Launched Oct., 1902.
Suffolk	9,800	Portsmouth.	" Jan., 1903.
Berwick	9,800	Glasgow (Beardsmore).	" Sept., 1902.
Cumberland	9,800	Govan { London & Glasgow.	" Dec., 1902.
Lancaster	9,800	Elswick.	Building.
Donegal	9,800	Govan (Fairfield).	Launched Sept., 1902.
Protected Cruisers.			
Challenger	5,880	Chatham	Launched May, 1902.
Encounter	5,880	Devonport.	" June, 1902.
Topaze	3,000	Birkenhead (Laird).	Building.
Amethyst	3,000	Elswick (Armstrong).	" (To have Parson's turbines.)
Diamond	3,000	Birkenhead (Laird).	Ordered.
Sapphire	3,000	Yarrow (Palmer).	"

VESSELS BUILDING.—*Continued.*

Name.	Displacement.	Where Building.	Remarks.
Gunboats.			
Cadmus	1,090	Sheerness.	Launched April 29.
Clio	1,096	"	Launched.
Scouts.			
Adventure	2,750	Elswick.	Building.
Forward	2,845	Fairfield.	"
Pathfinder	2,610	Birkenhead.	"
Sentinel	2,900	Barrow.	"
5	2,800	Vickers.	?
6	2,800	Fairfield.	?
7	2,800	Elswick.	?
8	2,800	Birkenhead.	?
Torpedo Boat Destroyers.			
Erne	550	Jarrow (Palmer).	Launched Jan. 14, 1903.
Exe	550	" "	Building.
Ettrick	550	" "	"
Cherwell	550	" "	"
Dee	550	" "	"
Derwent	550	Newcastle-on-Tyne.	"
Eden	550	"	" Launched Mch. 14.
Waverny	550	"	"
Velox	550	"	Under trial.
Foyle	550	Birkenhead.	Launched Feb. 28.
Itchen	550	"	Building.
Arun	550	"	Launched April 29.
Blackwater	550	"	Building.
Ribble	550	London (Yarrow).	"
Teviot	550	" "	"
Usk	550	" "	"
Welland	550	" "	"
Kennet	550	Chiswick. "	"
Jed	550	" "	"

The Fairfield Company, at Glasgow, Scotland, builders of the Campania and Lucania, have just launched from their yard the first line-of-battleship they have built. They have accomplished the construction to this stage within ten months of the laying of the keel. When completed, it will be the largest battleship yet ordered. It is not quite accurate, however, to say—as had been said in the daily press—that this ship, the Commonwealth, has been launched in the shortest time from the laying of the keel. The keel was laid June 17, 1902, so that, as the vessel was launched on May 13, it has been brought to this state of construction in 10 months and 26 days. In 1899 the Devonport dockyard launched the Bulwark, seven months from the laying of the keel; the Portsmouth dockyard launched the London in nine months and 12 days; and Chatham floated the Venerable in exactly ten months. The launching weight of the Fairfield ship—about 8000 tons—is, however, greater than that of the dockyard ships; but, after all, the real test in shipbuilding is the date of completion, and all will look forward with interest to the ultimate end of the Fairfield performance. The prototype of the class to which the Commonwealth belongs—the King Edward VII—is to be launched by the Princess of Wales in July. Another ship of the type—the Dominion—is to be launched by Messrs. Vickers, Sons, and Maxim, in August, and the Hindustan, building at the work of Messrs. John Brown & Co., Glasgow, is to be floated in the early autumn; but this last named ship was laid down four or five months after the other vessels. This class of battleship is the largest yet ordered in the British navy. The length between perpendic-

lars is 425 feet, the breadth is 78 feet, with a draft of 26 feet 9 inches; her displacement will be 16,350 tons. The largest battleship in the British fleet displaces only 15,000 tons, but several of the later Japanese ships exceed this by some 150 or 200 tons. The Commonwealth has broadside armor extending 22 feet in depth, the thickness varying from 9 inches at the water line strake to 7 inches at the upper deck; while forward of the citadel formed by this armor and by athwartship armored bulkheads, the water-line is armored by 3-inch plates forward and 2-inch aft. The quick-firing guns, instead of being in casemates, are within the broadside armor, which is sponsoned out at the gun positions, to enable the weapons to have a large arc of training forward and abaft the beam. The pairs of 12-inch guns mounted forward and aft, are within barbettes, and there are at the four corners of the citadel four 9.2-inch guns, mounted singly in barbettes, so placed as not to interfere with the broadside fire of the large guns. There are in addition ten 6-inch guns, fourteen 12-pounders, and fourteen 3-pounders, with four torpedo tubes, all submerged. The machinery, of 18,000 horsepower, is supplied with steam from water-tube boilers at 270 pounds pressure, and it is expected that a speed of 18½ knots will be obtained.

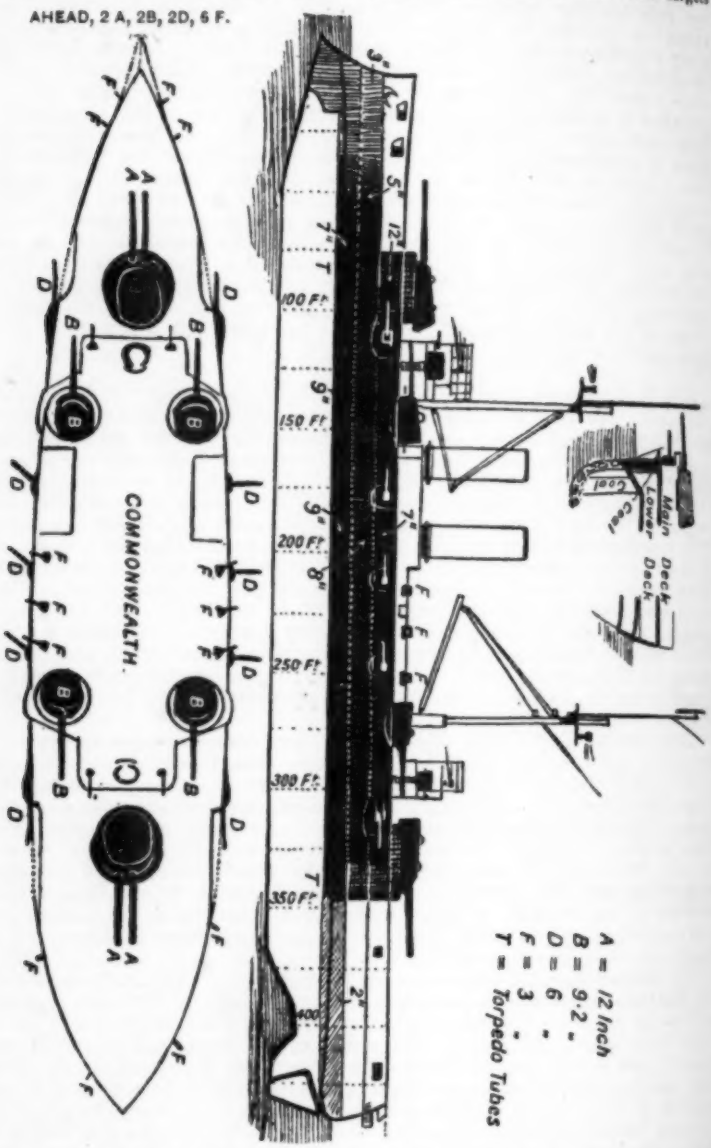
H. M. S. COMMONWEALTH.—We gave a brief description of this vessel last week. We now illustrate her, and supplement the description with the following particulars. Except the projected Russian ships, or the American Louisiana, there is nothing of the same displacement to compare with her. The Louisiana belongs to a later era, so we have selected the New Jersey as a fairer comparison. The Russian ships are not yet begun, or but barely so, and might therefore seem equally out of court. This, however, is hardly so; for, though of later date, they were designed as soon as the particulars of the King Edward VII class—to which the Commonwealth belongs—were known. It is the Russian policy to lay down something by way of a reply or copy, so soon as we get out a new design. Thus the Retvizan, though so lately completed, is Russia's equivalent to our Canopus, and the Birodinos, recently launched, are of the era of our Formidables and Londons. The French République is a smaller vessel by nearly 1400 tons, say nearly 10 per cent, but she is undoubtedly France's equivalent.

Now, looking at the four ships selected for comparison, we see at once that there are not four types but only two. The King Edward and the New Jersey, despite differences that, on paper at any rate, favor the American vessels, are essentially of the same type. Both have armored walls amidships, extending up to form a main-deck box battery, both have intermediate guns between the secondaries and primaries, which, though differently disposed, are carried in small turrets on the upper deck. That the New Jersey has superposed turrets is an incident, not an essential of the design. Finally, both rely for protection on a moderate belt reinforced by a sloping armor deck, and have huge barbettes inside which the main turrets work.

The Franco-Russian ships are totally different. The exact nature of the Russian design is not known, but it is generally understood that she will be an enlarged Tsarevitch—a ship that we shall be dealing with at some later date. Essentially she embodies the integral features of the République—a ship we have fully described and illustrated in the past. The peculiar features are: (1) Complete belts, with flat decks at top and bottom; (2) moderate sized bases to big guns; (3) secondary guns, all in pairs, in turrets, carried mostly a deck higher than in the Anglo-American type. Instead of walls, stout tubes protect the bases of these, and between exist vast unarmored spaces.

From this it follows that the sort of fire that will destroy one type will hurt the other relatively little. For example, neither the Common-

wealth nor the New Jersey has much need to dread big common shell. Their large armored areas, on the other hand, render them ideal targets



for 12-inch armor piercing projectiles, which, hitting the relatively weak water lines, might get through to the engine rooms; and powerful 8-inch guns of high velocity might riddle the battery to a great extent.

Name	Commonwealth.	New Jersey. U. S. A.	République. French.	New Russian. Russian.
Nation	British.	15,000 nominal.	15,000 about.	16,000
Displacement, tons	16,350	435	438¾	?
Length, ft.	425	76¾	79¾	?
Beam, ft.	76	26¾	27¾	?
Draught (mean), ft.	26¾	Four 12-in., 40 cals.	Four 12-in., 45 cals.	Four 12-in., 40 cals.
Guns, A	Four 12-in., IX., 40 cals.	——	——	——
B	Four 9·2-in., X., 45 cals.	Eight 8-in., 45 cals.	——	Twelve 8-in., 45 cals.
C	——	Twelve 6-in., 50 cals.	Eighteen 6·4-in., 45 cals.	——
D	Ten 6-in., VII., 45 cals.	Twelve 14-pdrs.	——	Twenty 12-pdrs.
F	Fourteen 12-pdrs.	Twelve 3-pdrs.	Twenty-six 3-pdrs.	Twenty smaller.
Tertiary	Fourteen 3-pdrs.	Sixteen smaller.	Two 1-pdrs.	
	Two Maxims.	2	2	2
Torpedo tubes, submerged	4	——	3	2
" " above water	——	——	11-in.—6-in.	11-in.—6-in.
Armor belt	9-in.—2-in.	11-in.—4-in.	2¾-in. flat.	2¾-in. flat.
Deck	2-in. slope.	3-in. slope.	10-in.—6-in.	10-in.—3-in.
Lower deck side	8-in.—3-in.	6-in.	12-in.	12-in.
Barbette bases, A guns	12-in.	11-in.	12-in.	12-in.
Turrets	8-in.	10-in.	——	7-in.
On B or C guns	7-in.	6-in.	——	6-in.
Protection to bases	7-in.	6-in.	6-in. and 5-in.	——
On C or D guns (secondary)	7-in.	6-in.	5-in.	——
Protection to bases	8-in.	6-in.	18,000	?
I. H. P.	19,000	19,000	18	?
Speed, knots	19·5	19	900	1,800 (reported).
Normal coal	950	900	1,825	3,000 (reported).
Maximum coal	2,000	1,900	Carried.	Much carried.
Oil	none.	?		

In the Franco-Russian designs there is none of this. The secondary guns offer a trifling target, they are impossible to aim at modern ranges. The belts, indeed, are there to hit, but penetration only means that the projectile goes inside the armored box filled with coal; it is extremely unlikely to get through to the engines. These ships must be attacked by shell to do them much harm, and whatever is done they are very unlikely to sink. They will, if defeated, become floating rubbish heaps; the Anglo-American ships will, if defeated, go to the bottom in passable condition. He must be a rash or ultra-patriotic man who would assert that the King Edward class is better than the République, but whether she is worse is quite another matter.

No one can say. No one knows exactly what shell attack is going to do in battle. We think it will do a great deal; the French and Russians, apparently, are less believers in shell power. The real root of the matter, however, is quite unknown. No one can assess the chances of water-line hits or say how rare they will be. It is a sort of axiom that they will be rare; and there is logic in this view, because the water-line is a very small fraction of the total area presented by a ship.

Until she is so hit the Commonwealth will be pouring a tremendous fire, for all her guns are so far apart and isolated that it is not likely that anything entering the battery will hurt more than one or, at the most, two guns. Inferior as she is to the République in secondary pieces, she has an enormous advantage in her 9.2's. These guns, in addition to excellent penetration power, fire lyddite shell, which are likely to wreck pretty effectually any spot they hit. The damage done by lyddite is probably not at all extensive, not so extensive as that done by a common shell, but it is singularly complete locally. This sort of thing cannot be stood long by any ship, and even if it could be, there would be a rapid end to all communications. From all this trouble the Commonwealth is free. High explosive shell may burst against her armor, and, bursting, destroy gun muzzles; but they are not going to inconvenience her to any serious extent. She will, in all probability, be able to go on fighting.

The design of the King Edward class has been adversely criticized on the grounds that on 16,350 tons displacement at least two more 9.2's could have been carried. Or, to put it another way, she is bigger than she need be for her guns and armor. There is possibly some truth in this; but, in view of the recent accident to the Maine, we do not think that the unfavorable comparisons drawn between the King Edward and the New Jersey hold water. Indeed, her most serious competitor is a ship only three-quarters her size—the Vittorio Emanuele. The principal guns are:

King Edward.	Vittorio Emanuele.
Four 12in.	Two 12in.
Four 9·4in.	
Ten 6in.	Twelve 8in.
Fourteen 3in.	Eight 4in.
18·5 kts.	22 kts.
9in. belt.	10in. belt.

In a battle, no doubt the King Edward would have things her own way; but one is tempted to wonder what a 16,350 ton Vittorio Emanuele would be? The question has perhaps occurred before to a great many people in this country, and, indeed, is one of fascinating interest to us all. But only Colonel Cuniberti could answer it—speculations by anyone else would be vain.

In conclusion, we may mention a few details of the Commonwealth armor. The water-line belt is 9 inch K. C. amidships, tapering to 3 inches at the bow and 2 inches at the stern. This last, of course, is nothing; the 3-inch bow, however, does not reach far—it soon becomes 4 inches, and then 6 inches. This water-line belt is reinforced by the usual

inclined deck, 2 inches of steel—of course, not cemented, that process being impossible for thin plates. The total resisting value may be put at equivalent to a 12-inch Krupp, or a trifle more. A capped modern 10-inch with direct impact will get through this at 4000 yards by proving-ground statistics. In battle, of course, there will not be direct impact, or anything like it. All 12-inch guns are supposed to be able to get through this uncapped at 3000—but, again, no one expects them to do so in battle.

Above the 9-inch belt is an 8-inch one; above again, a 7-inch protecting the battery. The best nominal capped penetration of the 6-inch gun is the American one, 7.2 inches at 2000 yards. This battery, therefore, may be regarded as proof against any 6-inch gun in existence, or likely to be in existence yet awhile, for it is easier to talk of abnormal velocities than to secure them in practice.

The 9.2-inch guns rely rather on the inclined and bent surfaces of their turrets than on thickness. Probably in battle no capped 6-inch could get through them, but anything larger might. However, as anything big would probably be fully disastrous without getting through, these nickel 6-inch thick turrets are probably quite thick enough. The barbettes are of the usual form and thickness, made of K. N. C. 12-inch plates. There is a theory that these are either not thick enough, or else too thick. But this opens a very big question, better discussed at some other time.—*Engineer.*

THE NAVY'S ESTIMATE.—*The First Lord's Statement.*—The "Statement of the First Lord of the Admiralty explanatory of the Navy Estimates, 1903-1904" was issued on 9th March as a Parliamentary paper [Cd. 1478]. In accordance with the form adopted last year, the general "Statement" is followed by an appendix containing a detailed "Statement of Work, 1902-1903," reviewing the work accomplished in various departments during the administrative year now drawing to a close:

The estimates for 1903-4 amount to £34,457,000, as opposed to £31,255,000 for the current year.

Administration.—The expansion and reorganization of the Admiralty mentioned in my memorandum of last year is steadily proceeding on the principles therein laid down. The question of the organization of the controller's department was referred to a committee presided over by Admiral Sir Charles Fane, K. C. B., the report of which was of great assistance to the board. As the result, the controller's department as a whole has been strengthened; the controller himself has received a naval assistant, and in that and other ways has been relieved of the burden of details, responsibility for which has been entrusted to his subordinates. In the sphere of work of the director of naval construction a new sub-branch has been formed under an officer, styled the superintendent of construction, accounts and contract works, whose position towards the director of naval construction is analogous to that of the superintendent of naval ordnance stores to the director of naval ordnance. The result is that while the director of naval construction will be freer than he has ever been to devote his whole energies to the work of designing ships and of generally supervising their construction in accordance with his designs, the duty of the detailed superintendence of contract and financial work connected with construction will devolve on this new officer. The department of the engineer-in-chief has also been strengthened, and so better equipped to meet the constant increasing strain upon it. The engineer-in-chief is not only the responsible adviser of the Board of Admiralty on all questions of naval engineering, but he is also the official head of the engine-room branch of the *personnel* of the navy. These two duties do not seem to me to be necessarily connected, and in view of the constantly increasing importance of what are really the functions of a director of naval engineering, the time will, in my opinion, come when it will be more convenient to separate them.

As already announced, the board has decided to strengthen their equipment for dealing with specially difficult problems of marine engineering by asking a small committee of the highest recognized authorities in the country to consent to meet on occasion, when summoned by the controller, and give them the benefit of their advice on any question submitted to them. The naval ordnance store department, reorganized as an integral sub-branch of the naval ordnance department, as mentioned in my last memorandum, has worked admirably during the past year. The policy of separation of the naval from the military ordnance stores is being steadily pursued. It has for some time been complete at the home ports; it was finally effected at Malta last year; it will be carried out this year at Bermuda, and it is under present consideration in relation to Hong Kong. The representation of the navy on the ordnance committee has been strengthened by the addition of an officer of the Royal Marine Artillery, and the rear-admiral vice-president of the ordnance committee has become an associate member of the explosives committee.

The excellence of the organization of the transport department of the Admiralty has been proved by the readiness with which that department expanded itself to deal successfully with the vast calls made upon it in connection with the late war. As a result of the experience gained during the war the department has been permanently strengthened and its organization slightly modified.

The establishment of the naval intelligence department has been permanently increased during the past year by the addition of two naval officers of the executive branch, one marine officer, and a civil servant, and temporarily by the addition of one naval officer of the executive and another of the engineer branch, and of another marine officer. I have noticed some misconception in respect of this department which I should like to correct; it seems to be a prevalent idea that either the Board of Admiralty or the Treasury have crippled it by refusing it the funds wherewith to expand, and frequent comparisons are drawn between the magnitude of the work which must fall to it and the size of its staff, and that of the staff of various foreign nations. I am glad of this opportunity of stating categorically that this conception of the attitude of the Treasury has no foundation in fact, and that it is equally erroneous to suppose that the Board of Admiralty do not give their whole support to the director of naval intelligence in his all-important task. The fact is that the department is steadily expanding and will continue to expand, and it will have every assistance in its expansion which His Majesty's government can give it; but I am not prepared to admit that the only measure of the value of the work of a department is the size of its staff, or that an exact comparison is possible between the staff of our intelligence department and that of a foreign nation.

As is well known, the organization of the war mobilization of the fleet is part of the duty of the naval intelligence department, and this work is being constantly revised; but the full scheme of the board includes also the elaboration of the war organization of the Admiralty itself under the responsibility of the Secretary of the Admiralty, and aims at securing that each department of the Admiralty shall, at the same time as the fleet is mobilized for war, be able to mobilize itself immediately for war administration, and that as little as possible shall be left for decision when war breaks out. Every department will expand automatically and know exactly how to carry on without referring to the board for instructions.

The large programme of works which it has been necessary to undertake to meet naval requirements has involved a rapid increase in the staff of the works department, and it has been difficult to obtain sufficient entries of competent civil engineers to keep it up to its proper strength. The conditions of entry and service have been investigated by a commit-

tee, and on their recommendation certain changes are being made which should render the works department service sufficiently attractive to secure the entry by competitive examination of the best class of young men who are entering the engineering profession.

Personnel.—In my statement of last year I recognized my special responsibility for devising a remedy for the future for the absence from the flag list of a due proportion of younger officers, and the board have already taken steps in this direction. At first sight the question appears a simple one; it is, however, one of the most complicated that can be conceived, because any change in any direction affects the career of such large numbers of officers, and, unless fully thought out in advance, is liable to produce unexpected and undesired results. To assist them in elucidating this complicated problem the board appointed a committee consisting of Viscount Goschen, Admiral Sir Michael Culme Seymour, Bart., G. C. B., Sir Francis Mowatt, G. C. B., Permanent Secretary of the Treasury, Rear-Admiral E. S. Poë, M. V. O., Captain Sir W. Warrender, Bart., R. N., C.B., Sir Richard Awdry, K. C. B., Accountant-General of the Navy. This committee, to which and especially to its chairman, Lord Goschen, the board are deeply indebted, have presented their report. As this report has only just been received, the board have not yet had the opportunity of considering it, and I must reserve for a future occasion an examination of the question in detail.

I have again to emphasize in the strongest way the value of the war course at Greenwich for the senior officers of the navy as conducted by the captain of the college. The more the work of that course proceeds the more strongly emphasized is the necessity for its existence. It is not all officers who have turned their minds to the considerations of the many problems which will confront them in war, and the more this course stimulates the study of naval problems by officers of every rank the better it will be for the navy.

I have recently laid before Parliament in a separate memorandum the new scheme of entry and training of naval officers that I have little at present to add to it, except to repeat what was stated in a footnote that the board are well aware that the age at which the medical and accountant officers of the navy reach their relative rank requires readjustment. The board have adopted it as a principle that the age at which the relative rank is attained by the different branches of the service should be more closely equalized, and the details are now being worked out. New and important regulations affecting the medical branch and the naval chaplains respectively have come into operation during the course of last year. The new departure of sending forth term cadets to sea in the Isis has been an unqualified success. Not only has the time at sea been in no way detrimental to their studies, but the practical instruction has been such that they have been reported as already fitted to perform their duties as midshipmen on joining the fleet from the Isis.

The detailed plan for the future training of the men of the navy is being steadily elaborated. It will be first of all introduced in the Portsmouth command, and will provide, among other things, that in the future an able seaman, before receiving his rating as such, must possess some mechanical knowledge and a fair knowledge of the simple duties of the stokehold. On the same principles all obsolete instruction will be eliminated from the course on the boys' training ship, and elementary instruction in the use of mechanical appliances substituted for it. Much more time will also be devoted than hitherto to the instructions of the boys in gunnery. In old days the physical training of the seamen was provided for in the best possible way by their work on the masts and yards. This is no longer the case, and it has been necessary to provide an adequate physical training by other means. Some particulars as to the gymnastic training which is being organized will be found in the appendix.

The numbers voted for the current year were 122,500 officers and men active service ratings. This establishment will undoubtedly have been fully reached by the end of the financial year, and for next year the numbers proposed are 127,100. The increase will consist of the following ranks and ratings: Officers, 262; warrant officers, 95; seamen, 1637; artisans and electricians, 95; engine-room artificers, 200; stokers, 1830; miscellaneous, 411; boys (artificers, shipwrights, etc.), 70; total, 4600.

In accordance with the recommendations of the committee on naval reserves, presided over by Sir Edward Grey, it is proposed that 625 of the stokers and 375 of the seamen should be non-continuous service men. Legislation will be proposed to Parliament to enable the Board of Admiralty to make it a condition of enlistment for non-continuous service that after a limited period of service in the fleet the men so enlisted should join the Royal Fleet Reserve for the unexpired portion of 12 years. The board owe a deep debt of gratitude to Sir Edward Grey and his colleagues for their work; the recommendations of the committee will assuredly be of great value to the board. I trust that as the result of the work of the committee a principle and standard in respect of the manning of the navy will be adopted by the board which will receive the seal of the concurrence of Parliament but, in view of the constant demands that are made in various quarters that additional ships should be placed in commission, I wish to lay stress on the fact that the number of the active service ratings must continue to increase disproportionately to the growth of the reserves unless a fairly constant ratio is observed between the ships in commission and the ships in reserve. On mobilization for war each freshly-commissioned ship will receive a crew drawn partly from the active service ratings and partly from the reserves, in carefully approved proportions; but in time of peace a ship in commission can only be manned by active service ratings, the reserves—except for training in ships of the home fleet—not being available for this purpose. It consequently follows that at each additional commissioning in time of peace either the establishment of the active service ratings must be increased, or the number of active service ratings required to give the proper proportion to reserves will be deficient at the moment of mobilization for war.

The Calypso, fitted as a drill ship, has been stationed at St. John's, and the board are glad to be able to announce that with the assistance of the Colonial government the Newfoundland branch of the Royal Naval Reserve is fairly started. It at present numbers some 180 men.

I have frequently expressed the views of the Board of Admiralty as to the overwhelming importance of proficiency in gunnery, and I am able to state positively that the whole of the navy are striving, both officers and men, to reach the highest standard. It has recently been decided to award a medal (carrying with it a bonus) to be worn on the right breast to the captains of the guns, seamen or marines, in each ship, who are judged by the captain to be the best shot in that ship during the year with each nature of gun, conditionally on their attaining a minimum standard to be approved by the Admiralty. Gunnery is often spoken of as merely a question of money, but I entirely demur to this view. I do not believe that any amount of money prizes would stimulate the fleet to as great exertions in this matter as their patriotism and sense of honor and duty are doing now. To make it a question of money is to lower the standard of duty, and in the end to deteriorate the proficiency of the ship for the purposes of war. The inevitable tendency of wholesale money prizes is to create an artificial atmosphere of competition as unlike as possible to the reality of war. Further, I must point out that the conditions under which different ships shoot differ so widely that there would be grave risk of injustice and of consequent discouragement if any attempt were made to single out one ship in the year as the best shooting ship in the navy, or

one man as the best shot in the navy. On the other hand, it is quite possible to judge which man in each ship is the best shot with each nature of gun, and to mark him out for honor accordingly as the board have done. The fact is that excellence in gunnery is a question only of endeavor and of a sound system of training.

Construction and Reconstruction, and Repairs.—All the money voted for the year 1902-3 will have been earned and spent by the 31st March. The amount proposed in the estimates for 1903-4 for new construction is £10,137,000, of which £1,150,000 will be devoted to the commencement of new ships. The corresponding amounts for the current year were £9,058,000 and £700,000 respectively. Since my last statement was presented to Parliament the board have considered carefully the report of the committee on the past arrears in shipbuilding; they believe that the light shed on the subect by that report has been of much value, and they have accordingly taken every opportunity of profiting by its recommendation. Between the 1st April, 1902, and the 31st March, 1903, inclusive, the following ships will have been completed and passed into the Fleet Reserve:

Battleships—London, Venerable, Russell, Montagu.

Firstclass-armored cruisers—Bacchante, Good Hope, Drake, Leviathan, King Alfred.

Sloops—Odin, Merlin.

4 destroyers, 3 torpedo boats, 6 submarines.

Repair ship—Assistance.

Distilling ship—Aquarius.

On 1st April, 1903, there will be under construction: 11 battleships, 19 armored cruisers, 2 second-class cruisers, 4 third-class cruisers, 4 scouts, 2 sloops, 19 destroyers, 8 torpedo-boats, 3 submarines. And it is expected that between 1st April, 1903, and the 31st March, 1904, inclusive, the following ships will have been completed and passed into the Fleet Reserve: 6 battleships, 11 armored cruisers, 1 second-class cruiser, 2 sloops, 4 destroyers, 8 torpedo-boats, 3 submarines.

It is proposed to commence during the financial year 1903-4: 3 battleships, 4 first-class armored cruisers, 3 third-class cruisers, 4 scouts, 15 destroyers, 10 submarines.

It will also be necessary to build a new admiralty yacht, the old Enchantress, which has been going for nearly forty years, being no longer seaworthy, another shallow draft river steamer for the China station, and 2 vessels for naval reserve work.

Much progress will have been made by the 31st March next in the policy of reconstruction, announced in my statement of last year, as will be seen from the following list: Completed—Battleships (Royal Sovereign class) Empress of India, Resolution, Revenge, Royal Oak; first-class cruiser, Powerful; second-class cruisers (Talbot class), Doris, Venus, Dido, Isis. In hand—battleships, Barfleur, Centurion; first-class cruiser, Terrible.

Owing to the great pressure of work in the dockyards it has been decided to allow the contractors who are building the ships to complete them in all respects ready for commission, by which means all the shipbuilding firms who construct war vessels will gain further experience and be better prepared to undertake naval work. The completion of these ships will entail an increase of the controller's naval staff in order to ensure that the ships are fitted in every way in accordance with the usual custom of the service, and to avoid any alterations or additions at the dockyards after final delivery. The policy of relieving the congestion of repairs in the dockyards by sending ships to be repaired by the private firms which built them has been largely followed, and the board propose to continue the policy, which I am convinced is for the advantage of the navy.

The subject of subsidized merchant cruisers has been brought to the

front by the reports of the inter-departmental committee, over which Lord Camperdown presided, and of the committee of the House of Commons, of which Mr. Evelyn Cecil, M. P., was chairman, and by the creation of the great American shipping combination. Subsidized merchant cruisers can never be a substitute for His Majesty's cruisers, but they will have their special uses. It did not seem to the board right that any ship should be in existence which, in case of war, no ship at the disposal of the board could reasonably expect to catch, and they were accordingly glad when, for this reason among others, His Majesty's government decided, should Parliament approve, to give such a subsidy to the Cunard Company as will enable them to build two steamers of superior speed to anything afloat, which will be entirely at the disposal of the Admiralty in time of war. This, in the opinion of the board, was definitely the most economical method of effectually meeting a special need. Before the current agreement in respect of subsidized merchant cruisers with the various steamship companies expires, two years hence, the board will have to consider their policy in respect of ships of no special speed in the light of the reports of the two committees already mentioned.

Since my last statement the boiler committee have presented their final report on the questions referred to them, and I have announced that the policy of the board, until further experience has been gained with the various types of water-tube boilers now being placed in His Majesty's ships, is to adhere to a combination of four-fifths water-tube of certain types recommended by the committee, and one-fifth cylindrical boilers. I have never attempted to minimize the difficulties which have been caused to the fleet by the adoption of Belleville boilers; these difficulties were due partly to the faulty manufacture of the first series of such boilers, partly to the great increase of pressure, and partly to the initial want of training of the *personnel* in their management, but they were mainly *ejusdem generis* with those which the navy had for years to contend with on the first adoption of the various kinds of boilers which preceded them. As each of the earlier Belleville boiler ships comes in for refit on the termination of her commission she is being placed in thorough repair and made absolutely efficient for service. . Owing to the experience gained no further difficulties ought to occur with these ships, and, although the board agree with the boiler committee in considering other types of water-tube boilers to be much preferable, they also share the committee's view that to replace these boilers by others in the ships which already have them would be an unjustifiable, because an unnecessary, expense. I warned Parliament that the cost of repairs for the boilers of the earlier ships fitted with water-tube boilers would prove to be very heavy; but at the same time I pointed out that the history of the experience of the use of any new invention generally proceeded on similar lines, and that, in my opinion, the water-tube boiler had come to stay. Conflicting opinions on this subject are held so strongly that experience only can decide between them. On the one hand is arrayed the opinion of those who absolutely condemn the water-tube boiler, on the other the deliberate policy of every naval power, the report of our own recent boiler committee, and the opinion of every naval officer who is in command of a squadron which would have to act in war or who has the responsibility for decision at the Admiralty. If, as I believe will be the case, the offensive and defensive features of the new class of battleship now being designed, and of the Duke of Edinburgh class of armored cruiser, give general satisfaction, it must be remembered that these results could not have been produced on anything like the displacement of these classes of ships but for the adoption of the water-tube type of boiler.

The destroyer fitted with the turbine system of machinery, the Velox, alluded to in my last statement, is now going through her trials, and so has enabled the board to resume their experiments.

The experiments with oil fuel referred to in both my last statements have been steadily prosecuted with constantly encouraging results, and two battleships of the Channel squadron, the Mars and the Hannibal, and the new armored cruiser Bedford are now being fitted in respect of some of their boilers for a more extended trial, both with oil fuel and with oil fuel in combination with coal. The problem which the navy has to solve in the use of oil fuel is a much more difficult one than that which the mercantile marine has had to solve, because oil fuel can be of no use to the navy as compared with Welsh steam coal unless the combustion can be brought to such perfection as to render the fuel practically smokeless.

Distribution of the Fleet.—The proposals of the Board of Admiralty in respect of the Australian squadron are contained in the papers which have been laid before Parliament in connection with the recent colonial conference, and I need not refer to them further here as those proposals have still to be discussed by the Parliaments of the Commonwealth and New Zealand. It has been decided to sever the West Coast of Africa from the Cape station and to form a new squadron to be called the South Atlantic squadron, which will serve the southeast coast of America and the west coast of Africa, and use Gibraltar and Sierra Leone as its bases.

The policy of changing the composition of the Home, Channel, and Mediterranean squadrons of battleships so that, like the China squadron, they shall be composed of homogeneous classes of ships, is steadily progressing, and will be continued in the coming year. Both the Mediterranean fleet and the Channel squadron have two armored cruisers apiece of the Cressy class, and the Cruiser squadron, which has lately been placed under the command of a rear-admiral, will shortly I hope, be composed only of 23-knot vessels, viz., two of the Drake and four of the Monmouth class.

Two additional rear-admirals have been appointed to the Mediterranean, one for service with the Cruiser division of the fleet and one as senior naval officer at Gibraltar, the importance of which as a base is so greatly increased by the approaching completion of the moles and docks.

The fleet in home waters has been reorganized and placed under the orders of a vice-admiral in command, with a rear-admiral as second in command. His duties and responsibilities in respect of home waters are analogous to those of the commander-in-chief in the Mediterranean, except that they will in no way overlap or impinge upon the authority of the commander-in-chief of the three home ports within their respective commands. The Home fleet is quite independent of the Channel squadron; it has as its nucleus of battleships the Home squadron, consisting of the former port guard-ships, which have been withdrawn from this service, and it has its headquarters at Portland. This squadron, in combination with the coast-guard battleships and cruisers, composes the Home fleet, which assembles three times in each year for joint exercises. Under the orders also when required of the admiral commanding the Home fleet will be the several destroyer flotillas along the coast, which are now organized each under its own captain and commander, with a stationary parent ship and supervised by an inspecting captain of destroyers, who is responsible for the general organization of the whole. Sheerness dockyard will be specially organized to undertake large refits and repair work for destroyers and torpedo-boats. The admiral-superintendent of naval reserves, whose duties will be largely increased in the future by the growth of the reserves, will have separate and independent functions, and will no longer command a seagoing squadron.

The increase of the fleet in commission and reserve in home waters, and the consequent congestion of accommodation both for ships and men at the three home ports, led the late board to appoint a committee to inquire into the whole question. After full consideration of the report of this committee, presented in January, 1902, the board came to the

conclusion that the time had arrived for the creation of a fourth naval base and depot in the United Kingdom. After an examination of all the available sites and a thorough consideration of the question in its industrial and strategical aspects, necessarily extending over a good many months, the board selected the Firth of Forth as fulfilling all the requirements of the navy. Provisional negotiations have been proceeding for some weeks past, and proposals will be submitted to Parliament in the course of this session for the acquisition of the land necessary to establish there a fourth home port.

I append the usual statement of the work done in the past year by the various departments of the Admiralty.

SELBORNE.

14th February, 1903.

THE ESTIMATES.—The navy estimates for the year 1903-4 have been issued as a Parliamentary paper [49], and the following is an abstract showing the increases and decreases as compared with the corresponding vote for last year:

Votes.		Net Estimates.		Difference on Net Estimates.	
		1903-1904.	1902-1903.	Increase.	Decrease.
	I.—Numbers.	Total Numbers.	Total Numbers.	Numbers.	Numbers.
A	Total number of officers, seaman, boys, Coastguard, and Royal Marines	127,100	122,500	4,600	....
	II.—Effective Services.	£	£	£	£
1	Wages, &c., of officers, seamen and boys, Coastguard, and Royal Marines	6,312,800	5,962,000	350,800	....
2	Victualling and clothing for the Navy	2,292,500	2,023,500	269,000	....
3	Medical establishments and the services	259,000	246,500	12,500	....
4	Martial law	15,500	17,700	....	2,200
5	Educational services	116,100	101,700	14,400	....
6	Scientific services	69,400	65,600	3,800	....
7	Royal Naval Reserves	297,500	286,900	10,600	....
8	Shipbuilding, Repairs, Maintenance, &c.:—				
	Section I.—Personnel	2,991,800	2,661,500	330,300	....
	Section II.—Matériel	4,786,700	4,812,700	....	26,000
	Section III.—Contract work	9,571,500	7,665,800	1,905,700	....
9	Naval armaments	3,206,100	3,356,400	....	150,300
10	Works, buildings, and repairs at home and abroad	1,502,000	1,100,000	402,000	....
11	Miscellaneous effective services	409,500	368,000	41,500	....
12	Admiralty Office	306,400	294,300	12,100	....
	Total effective services	32,136,800	28,962,600	3,352,700	178,500
	III.—Non-Effective Services.				
13	Half-pay, reserved, and retired pay	784,300	782,100	2,200	....
14	Naval and marine pensions, gratuities, and compassionate allowances	1,186,300	1,160,700	25,600	....
15	Civil pensions and gratuities	350,100	350,100	....	....
	Total non-effective services	2,320,700	2,292,900	27,800	....
	Grand Total	34,457,500	31,255,500	3,380,500	178,500
	Net Increase			£3,202,000	

THE NEW NAVY PROGRAMME.—The most important point in connection with the new navy programme for the next financial year is that it provides for the building of forty-two new warships of every tvpe, from battleships to river gunboats, and that all of these, with the exception of one armored cruiser to be built at Pembroke dockyard, will be given out to contract. For private firms we have, therefore, three battleships, three armored cruisers (with a fourth for the dockyards), three protected cruisers, four scouts, fifteen torpedo-boat destroyers, ten submarine boats, two coast-guard cruisers, and one river gunboat. In addition, there are belonging to the non-combative branch of the fleet a new admiralty yacht already ordered from Messrs. Harland and Wolff, and a surveying ship, nine steam mooring lighters, and one new luggage lighter. Though no indication is afforded as to the design of any of these new ships, it may be taken that the battleships will be still further improvements in respect of gun power on the King Edward VII class, which appear as costing from £1,350,000 to £1,426,266 each. But none of these new battleships will be given out until late in the autumn, as the sum laid aside for each before March of 1904 is only £44,660. In the case of the armored cruisers, however, £107,950 is to be spent on each of the contract ships, so that as they will resemble the new Duke of Edinburgh and Black Prince, they may be given out earlier. For the protected cruisers only £5700 is laid aside, which means that it is proposed to defer the ordering of these until the trials of the first of the third-class cruisers ordered a year ago, and one of which is to be fitted with turbines. The scouts will come out earlier. So also will the destroyers, especially as the first of the new type of heavy sea boats of 25½ knots speed will be ready for trial in a few weeks' time. The ten submarines will also be hurried forward. In their design they will embody improvements, especially in the system of propulsion, the gasoline engine which gave trouble the other day being superseded in all the later boats now completing. The two coast-guard cruisers are to be of a new type. Altogether on the new work over a million will be spent as compared with £700,000 a year ago.—*United Service Gazette.*

The new building programme cannot be accused of exhibiting undue ambition, for three battleships and four armored cruisers do not represent anything abnormal. Our constructive needs are determined for us by one of two causes—the personal fancy of the Admiralty, or the building policy of possible enemies. It is the latter of these that must be the standard by which the adequacy or otherwise of a programme is to be judged, and, thus considered, the new programme is not by any means fully satisfactory. Taking France and Russia as the two-power standard, we find that projected ships "to be built" by France are two first-class battleships of the modified République class, and two altered Gambetta type cruisers. Russia projects five or six monster battleships, and from three to five first-class armored cruisers. Now this totals to a minimum of seven battleships against our three, and at least five big cruisers against our four. Obviously, therefore, our programme is not up to standard. Then, too, Germany—at present the third naval power—cannot be ignored. Germany is going to lay down two new battleships a little before our three will be commenced, and at least one cruiser—though this will be a relatively unimportant vessel. Then the United States—though in no way to be regarded as a probable or even possible enemy—projects a couple of big battleships and two big armored cruisers fully equal to any first-class battleship at present afloat.

It is a favorite official excuse for small programmes that we build more quickly than other nations, but there is now comparatively little truth in this. Germany has turned out her Wittelsbach class quite as quickly as we have produced our Duncans, and even Russia is exhibiting remarkable celerity with the Borodinos. France, with her Henri IV five years in completion, has earned a reputation for slowness which she hardly de-

serves, for French delays as a rule will, on examination, be found bound up with the red tape system of steam trials. The Suffren, for instance, was virtually complete enough for war a year before she was officially "ready."

The second official excuse for small building programmes is that the means to build more do not exist. This is absurd in view of the batches of ships which we have built in the past. Elswick, Barrow, Clydebank, the Thames Ironworks, Laird's could build two, if not three, ships each were the demand made, and there are several other firms beside these. The relative inadequacy of the programme is, therefore, probably due to financial considerations. These, where construction is concerned, should not be rated too highly, for since warship construction conduces to the direct or indirect prosperity of a not inconsiderable portion of the inhabitants of these islands, money expended in shipbuilding is by way of being a national benefit. Those who plead for economy in this direction do not we think, properly realise how utilitarian in our way is expenditure on ships, guns, and armor.

As regards the new battleships, it is generally understood that they will be of 18,000 tons—practically King Edwards with four extra 9.2-inches in them. The speed is to be 19 knots or more, and there is no question, we think, but that the new ships, despite all that may be urged against large dimensions, will be better value per ton than their predecessors. We have got to have stronger, swifter, and generally better ships than our probable enemies, and we cannot afford to sacrifice that need for the sake of any pretty theories about moderate dimensions. Indeed, the moderate dimension fad is one with which we have small patience, because, looking into history, we cannot find a time when it did not obtain, save, perhaps, in the case of Noah's ark. It was rampant in Tudor times, and also in the days of the Georges. However prettily the case may be argued on paper, however, nicely those who want to stand still may reason about limits, there is in practice no getting away from the fact that the bigger the ship the steadier she is, and the better the gun platform. Also ships of moderate size, having to be more numerous, occupy a greater space of water. This means that they cannot avail themselves of numbers so far as a rush is concerned; they have to come on one after the other, and so are exposed to destruction in detail. Since big ships need big docks, all administrations do what they can to moderate the rate of increase in displacement—else congestion might ensue. That the Admiralty recognize this has been made clear many a time, and so the increase on the King Edward dimensions is no mere whim, but an accommodating to progress that cannot in the nature of things be stayed.

It is understood that the new battleships will, like the French République, be completely belted, and we sincerely hope that this is so. The theory that a "soft-ended" ship will still float all right with her ends shot away is all very well as a theory, and well enough, too, for smooth water. But at sea, subjected to the violence of waves, a ship so treated will be in quite another case. Even if her stability does not become a minus quantity, her steering will, with tons of moving water dashing over the armor deck. A complete belt rising to the main deck is an essential to any modern battleship or armored cruiser, and probably six inches is the minimum thickness such a belt can have anywhere. Four-inch cemented armor is liable to be split by the mere burst of high explosives; non-cemented four-inch is apt to be penetrated like cheese. As for a two-inch belt, such as we have in the Canopus, we might as well have none at all—all a two-inch belt can do is to insure that shells will burst just inside it. We understand that the 7.5-inch gun will not figure in the new ship. This we hold to be a good thing, the 7.5-inch being neither an armor piercer of much use nor an easily handled manual shell gun. The 9.2-inch is in every way a preferable piece; of these the new cruiser will carry six, pre-

sumably, like the Duke of Edinburgh. It is improbable that the new vessels will embody any new type since only two of the Edinburgh's are yet in hand. The third-class cruisers are of doubtful utility; we much prefer the scouts. The large order for submarines will astonish most people. Our present efforts leave much to be desired and there is no guarantee that further boats will be any more useful.—*The Engineer.*

The battleship Montagu returned to Devonport on Saturday on the completion of her experimental gun trials in the Channel. The whole of the armament was tested, the main interest centering in the trials of the four 12-inch 50-ton wire-wound guns, which are mounted in pairs in two barbettes. Each of the guns was fired at the extreme elevation and depression, and also trained to the extreme right and left. The guns were also fired by hand power, which is provided for use in the event of the hydraulic machinery being disabled. The two after-guns were twice fired simultaneously with charges of cordite, each weighing 212 lbs. and projectiles of 850 lbs. As a test of rapid firing six rounds were fired from the after-barbette in 1 min. 55 sec.—*Engineer.*

The cruiser Bedford, at Devonport, is having eight of her boilers fitted for the burning of oil fuel, and with a slight change of appliances, they will also burn coal.

The new twin-screw sheathed sloop Cadmus whose keel was laid at Sheerness on the building slip on March 11, last year, was launched on April 28, by Mrs. Graham, wife of the captain-superintendent. The Cadmus, which is sister ship to the Clio, recently floated out, has been built from the designs of Sir William White and is to be ready for commissioning by December 15 next. She has a length of 185 feet, a breadth of 33 feet, and a mean load draught of 11 feet 3 inches. The triple-expansion engines of 1400, built by Messrs. J. S. White, are supplied with steam by four Niclausse water-tube boilers, and the estimated speed will be 13.25 knots. The armament will consist of six 4-inch quick-firers, four 3-pounders, and three Maxims. The last Cadmus was a corvette, and it is more than thirty years since a Cadmus was seen in the Medway, if one excepts the old watch vessel of that name so long stationed at East Swale. —*Army and Navy Gazette.*

Messrs. R. and W. Hawthorn, Leslie and Co., Hebburn, launched on Saturday, March 14th, the new torpedo-boat destroyer Eden, built to the order of the Parsons Marine Steam Turbine Company, Limited Wallsend, for the British Admiralty. The Eden is the second of the new class of torpedo-boat destroyers launched from Hebburn shipyard this year. Her dimensions are: Length, 220 feet; beam, 23 feet 6 inches; and depth, 14 feet 3 inches; speed on trial, 25½ knots when carrying a load of 125 tons. The armament of the vessel consists of: One 12-pounder quick-firing gun on the top of the conning tower on the forecastle; five 6-pounder quick-firing guns on the upper deck, namely, two forward, two amidships, and one aft on a special raised platform; also two 18-inch torpedo-tubes, one amidships and one aft. The main propelling machinery consists of three Parsons compound steam turbines, viz., one high-pressure in the centre of the ship, and two low-pressure turbines, one on each side of the vessel, each turbine driving a separate shaft with propellers, three lines of shafting in all. Inside the exhaust casing of each of the low-pressure turbines a reversing turbine is fitted. For maneuvring purposes the outer shafts only are used the steam admission to the high-pressure turbine is closed, and by means of suitable valves the port and starboard engines can be worked ahead or astern, independently of each other and of the high-pressure turbine. In addition to the main propelling machinery, two small turbines are fitted for cruising at low speeds, one being fitted to each of the outer shafts. The vessel will have four water-tube boilers of the modi-

fied Yarrow type, distributed in three boiler-rooms. The boilers have been manufactured at Messrs. Hawthorn, Leslie and Co.'s St. Peter's Works for the Parsons Marine Steam Turbine Company, Limited, Wallsend.—*Engineering.*

The turbine destroyer Velox has just completed a series of steam trials on the Tyne to determine her acceptance by the Admiralty as a 27-knot vessel, but, says the *Western Morning News*, the results were so unsatisfactory that the Admiralty require the trials to be repeated. The coal consumption on the full-power trials was considerably in excess of the maximum laid down by the Admiralty. On the last full-power trial the mean speed realised was 27.07 knots, and the consumption of coal worked out at 9 tons 16½ cwt. per hour. The steam pressure on the four Yarrow boilers is 200 lb. per square inch, the vacuum 27-inch, revolutions of turbines 840 per minute. A coal-consumption trial with the reciprocating engines gave more satisfactory results. These engines are designed to propel the vessel at cruising speeds only, and the trial was of twelve hours' duration at 11 knots, with the following results: Steam in boilers, 212 lbs.; vacuum, 28.25 inches; revolutions, 351.4; speed, 11.26 knots; coal consumption, 8.58 cwt. per hour.—*Engineer.*

The eighth Holland submarine boat building for the British Navy has been launched from the Barrow Works of Vickers, Sons, and Maxim. This vessel is 100 feet in length, and embraces features not included in the first five boats ordered.

Submarine A2, built for the British Admiralty, was launched by Messrs. Vickers, Sons & Maxim from their yard at Barrow on the 16th April. There was no launching ceremony. This is the largest submarine yet built for the navy, and the vessel contains very many improvements, the outcome of recent experiments made at Portsmouth. Two other submarines of a similar size are in course of construction, and it is probable that others will shortly be built.

Although no definite decision will be come to for some time, it is stated that it is very probable that the orders for the four "scouts" embraced in this year's programme will be given to the firms that are now constructing the ships of the same type authorized under last year's vote, as extra reward for the attention they devoted to meeting all the requirements of the Admiralty in the designs. The firms are Vickers, Armstrong, Fairfield, and Laird Brothers. Every effort has been made to bring about as close a similarity in these vessels as possible; there are differences in form, which none of the firms care to alter and yet be responsible for the realisation of contract stipulations. The Vickers ship is the largest, and may as a result be the most seaworthy, her displacement being 2900 tons, so that the machinery requires to be of 17,000 I. H. P. in order that the 25 knots may be realised with the load of 150 tons on board. The Fairfield ship is the smallest, being 2545 tons; Armstrong's is 2750 tons, and Lairds' 2610 tons, these three having engines of 16,000 I. H P. The Vickers ship again is the "beamiest," for she has 1 foot of breadth to every 9 feet of length; while the Fairfield boat, which comes next, has 1 foot to 9.35 feet, Lairds' 1 foot to 9.47 feet, and the Elswick ship 1 foot to 9.73 feet. Thus the Armstrong ship is 370 feet long, with a beam of 38 feet, and a draught of 13 feet 3 inches. In Lairds' ship the breadth and draught is the same, although the length is 10 feet shorter (360 feet). The Fairfield and Vickers ship is the same length (360 feet), but the Clyde boat is to have a breadth of 38 feet 6 inches and a draught of 13 feet 1 inch, while the Vickers boat will be 40 feet broad and of 14 feet 2 inch draught. The comparative results of progressive speed trials will thus be very interesting. All the ships will have the same capacitites for coal, stores, guns, and ammunition, the principal armament being ten 12-pounder guns.—*United Service Gazette.*

News from the Mediterranean shows that a great improvement has taken place in the shooting of the British fleet. Four months ago Sir Compton Domvile, the commander-in-chief predicted better returns in the matter of straight shooting. The admiral's predictions have turned out to be correct. Throughout the fleet the percentage of hits has been raised from 33 per cent to just over 50 per cent. Most of the battleships, indeed, have scored over 55 per cent of hits. The Formidable has done especially well. After the celebrated occasion on which she made 26 misses out of 27 shots fired, certain irrepressible jokers named her the "Tame Mouse" but her brilliant performance has won back her right to the proud name she bore. Her bad shooting was largely due to defective sights. In fact, she had not a fair chance when she made so dismal a record.

An interesting experiment was carried out by the Portsmouth destroyer flotilla, after putting in the weekend at Poole, in regard to "raising steam" preparatory to getting under way. At 8.30 in the morning the signal was suddenly made. "Raise steam for 15 knots with all despatch." This was a severe test for all boilers were cold. The Syren, Senior Officer's ship, was an easy first, having accomplished the order, and warmed through preparatory to moving engines, in the space of 58 minutes, the Porcupine being second, 25 minutes later, closely followed by the Fervent, five minutes later; the Sylvia taking fourth place, followed by the Zebra, Lightning, and the Shark, all under two hours. The experiment was a novel one for the flotilla, and proved most instructive, as various classes of water-tube boilers were in competition with each other. Until the order was given, the strictest secrecy was observed, none of the vessels expecting it.—*Army and Navy Gazette.*

At the end of this month Chatham naval barracks will be commissioned. Five thousand men for countless years have inhabited and crowded the stationary hulks, on the grounds that a sailor must live afloat and not ashore, lest he deteriorate. At last this old idea is passing away, and the doctor's bill should be reduced in consequence.—*Engineer,* April 24.

In reply to Mr. Gibson Bowles, in the House of Commons, Mr. Arnold-Forster states that the following alterations have been recently made in the regulations governing the supply of ammunition for practice purposes:—1. The allowance to guns mounted on tops of turrets and barbettes was increased in March, 1899, from ten rounds per gun a quarter to 40 rounds. 2. The ammunition for aiming rifle practice for heavy guns was increased at the same date from 60 to 100 rounds a quarter. 3. The following additional ammunition is now allowed to every man qualifying for the ratings of acting second captain of gun and acting qualified gunner:—Acting Qualified Gunner.—Aiming rifle, 20 rounds each; light q.-f. gun, 5 rounds each; heavy gun, 5 rounds each. Acting Second Captain of Gun.—Aiming rifle, 20 rounds each; heavy gun at towing target, 10 rounds each. This alteration was made in April last. 4. There is also an additional allowance of 200 rounds per quarter of Morris tube ammunition for use with the deflection teacher for each captain and second captain of gun. This alteration was made in February last. 5. The new prize firing regulations, now about to be issued, provide for turret and barbette guns carrying out prize firing, by the method of independent firing, instead of as heretofore firing singly. This will increase the expenditure of ammunition under more practical conditions. 6. Firing of lyddite shells in addition to the ordinary allowance of ammunition has recently been introduced. The proportion of eight rounds a quarter is the same for b.-l. guns and heavy q.-f. guns as it was for m.-l. guns, but there is an important exception with regard to the allowance for prize firing. Under the old regulations any excess of ammunition expended when prize firing was deducted from the following quarterly allowance, whereas there

is now no limit to the number of rounds that a gun fires when prize firing, and however many rounds in excess of the normal allowance is expended, the usual quarterly allowance is fired next quarter without any deduction. Provision is thus made for the exercise of the utmost rapidity of fire that can be attained.—*United Service Gazette.*

A return of casualties to ships of the British navy during the year ending December 31, 1902, was recently issued as a Parliamentary paper (404). From this return it appears that during the period mentioned 52 casualties occurred and 32 inquiries were held, with the result that in 18 cases the officer or other person responsible was cautioned, reprimanded, or otherwise punished, while in the remaining 34 cases no blame was attributable. Out of 43 accidents, 26 were cases of collision and 5 were wrecks, the latter being those of the Sybille, cruiser, the Viper, torpedo-boat destroyer; the Cobra, torpedo-boat destroyer, and the Flora and Active, coastguard tenders. One death was caused by the wreck of the Sybille; 2 by the bursting of a boiler in the Daring, torpedo-boat destroyer; 1 by the bursting of a hose in the Racer, sloop; 67, including 23 civilians, by the loss of the Cobra, torpedo-boat destroyer; 3 by the accident to a boat of the Forth; 6 by a gun accident on board the Royal Sovereign; 20 by the wreck of the Active, and 2 by the collision between the Salmon, torpedo-boat destroyer, and the steamship Cambridge.

As a rule the time during which the vessel was in dockyard hands for repairs is measured by days, in a few cases by weeks, and in 4 only by months. The disablement of the port engine of the Rocket, torpedo-boat destroyer, kept her in the yard for seven months, but 5 of these were occupied in waiting for machinery from England. The Fawn, torpedo-boat destroyer, was 2 months under repair after a collision. The Daring torpedo-boat destroyer, was 7 months in hand after her boiler burst. The Indefatigable grounded in the river St. Lawrence, and was two-and-ahalf months in the dockyard under repair.

The greater number of casualties were of a comparatively trifling character, and were such as are inseparable from the risks essential to the effective handling of the destroyer flotillas.

The results of the special series of trials by the armored cruiser Monmouth, to test a new form of screw propeller have now been collated, and the facts are important, as are all data bearing on the question of the efficiency of propellers. It will be remembered that the earlier ships of the County class fell slightly short of their designed speed, although the contract requirements as regards engine-power were exceeded. The new propellers of the Monmouth had increased surface and greater pitch, thus the area was 80 square feet as compared with 57 square feet in the screws originally designed for earlier ships by the Admiralty as the result of tank experiments, and at the same time the pitch was increased from 19 feet 2 inches to 20 feet. This was a pretty severe tax on the engines, but the boilers, worked at full pressure, gave plenty of steam without trouble. At full power the engines of the Monmouth, running at a mean of 138.9 revolutions, developed 22,185 indicated horsepower, and the speed was 22.8 knots. The Bedford with the original propellers got 22.7 knots for 22,457 I. H. P. At four-fifths power, again, the results were similar—the Bedford for 16,005 I. H. P. attaining a speed of 21.2 knots, and the Monmouth for 16,319 I. H. P. realising 21.4 knots. But the bottom of the hull of the Monmouth was very dirty and the weather was unfavourable, and there remains no doubt that when clean the 23-knots rate anticipated in the design will be exceeded; the Kent, after her hull was cleaned, added about a sea-mile per hour to her full-power speed when dirty. At the same time, the addition to speed resulting from the change of propellers is scarcely as much as may have been expected. Progressive speed runs were also made by the Monmouth. With 1748 I. H. P. the speed just

exceeded 10 knots. For three nautical miles more it was necessary to more than double the power, making it 3584 I. H. P. For 7859 I. H. P. the measured mile runs showed a speed of almost 17 knots—to be exact, 16.93 knots—and to add two more miles per hour involved an additional power slightly exceeding that which realised the first 13 knots, the power for 18.98 knots being 11,066 I. H. P. The next 2½ miles required 5300 I. H. P. more, while the last 1½ knot took about 7000 I. H. P. more. Thus, as has before been experienced with similar ships, the last mile takes as much power as the first 15 knots.—*United Service Gazette.*

THE NEW NAVAL TRAINING.—The Lords of the Admiralty have issued a circular letter to commanders-in-chief, captains, and commanders of His Majesty's ships at home and abroad, indicating important changes in the system of training officers and men of the Royal navy. With regard to the training of seamen in mechanical and stokehold work, the circular states that proficiency in the use of simple mechanical tools and in stokehold work will in future form part of the examination for the rating of able seamen. For ordinary seamen qualifying for able seamen the course of training will be: (1) In the use of simple tools (under a chief or leading stoker), and working at water-tight doors, sluices, fire-mains, ventilation system, etc., as convenient; and (2) training in stokehold work. These regulations are to come into force on October 1, 1903.

Owing to the abolition of masts and sails, it has become necessary, the letter states, to establish a systematic course of physical training for the young officers and seamen of the navy. It has accordingly been decided to provide a gymnasium, with a proper staff of instructors, at each of the depots at the home ports, the headquarters and school of gymnastics and physical training being at Portsmouth, and to extend the system of instruction throughout the whole fleet. A commander has already been appointed as superintendent of gymnasia, with a lieutenant, R. N., as his assistant, and lieutenants, R. M., have been embarked in the flagships of the Mediterranean fleet and the Channel squadron as inspectors. Thirty-six seamen have passed through a six months' course of gymnastics, and have been allotted in the first place to ships of the Mediterranean fleet and the Channel squadron as instructors. For the purpose of supervising the instruction, the total staff of officers will be raised to seventeen.

Under the new system there will be three classes of gymnastic instructors, the first class receiving 1s. a day, the second class 6d. a day, the third class 2d. a day, in addition to the 2d. a day received for the non-substantive rating of qualified in gunnery (Q. G.) There will also be introduced eleven staff instructors, open to the best of the instructors, with pay of 1s. 3d. a day, and one senior staff instructor, with pay of 1s. 6d. a day, in addition to their pay of 2d. a day as Q. G. The total number of instructors eventually required will be:—Senior staff instructor, 1; senior instructors, 11; instructors, first class, 93; instructors, second class, 298; instructors, third class, 40; total, 443. The second class instructors will form the main body, and will be borne in all ships, in second and third class cruisers as the senior instructor, in larger ships under an instructor, first class. A first class instructor will be allowed to every battleship and first class cruiser, but not more than one to any ship. These regulations to come into force on April 1, 1903. Their lordships recognize that they can only be introduced gradually, and that experience may show that some modifications are necessary.

Their lordships have at present under their consideration a new curriculum for the instruction of boys in the training ships, which will shortly be issued. It is intended to largely substitute physical and mechanical training for mast and sail drill and such other drills as are not suited for the training of a modern seaman. All drill with arms will be eliminated from the gunnery instruction of boys, second class, and gymnastics and squad drill will be substituted. Drill with arms will form part of the

instruction of boys, first class, and the gunnery and mechanical training of boys, first class, will be extended.

New regulations for the training of seamen in gunnery and torpedo will shortly be issued. The general plan on which these regulations are being framed is to carry out more of the instruction of the lower gunnery and torpedo ratings at sea and at the barracks, and thereby leave the schools more free to perfect the instruction of the higher ratings.

A limited number of boys will be entered half-yearly for training in the Fleet Reserve for the rating of engine-room artificer. The number entered each half-year will consist principally of boys taken from successful candidates at an open competitive examination, which will be conducted by the civil service commissioners at the same time and in the same manner as the examination for dockyard apprentices. A limited number of nominated candidates, not exceeding fifteen annually, will be entered after passing a qualifying examination in the subjects laid down for competitive candidates.

For the rating of mechanician young and promising leading stoker mechanics will be generally eligible. Selected candidates will be required to pass the educational examination established for the rating of acting engine-rom artificers fourth class. Mechanicians will rank as chief petty officers immediately after engine-room artificers, and will be eligible for promotion to higher ranks in the same manner as the engine-room artificer. Chief or leading stokers will be eligible for the non-substantive rating of yeoman of stores, which will be allowed in the engine-room complement of every sea-going ship, without, however, an increase in numbers. The engineer officer, in such ships as the Admiralty may direct, will in future be allowed to select a stoker to perform the duty of engineer's writer, without, however, an increase in numbers.

After referring to the regulations relating to the promotion of chief engine-room artificer and artificer engineer, the circular states:

Their lordships have decided to introduce the commissioned rank of chief artificer engineer, and promotion to this rank will first be made in the year 1903-4. Chief artificer engineers will be under the same regulations as regards honorary rank on retirement, widows' pensions, and compassionate allowances, pensions for wounds and injuries, as chief gunners, chief boatswains, and chief carpenters. The regulations under which warrant officers, if under the age of forty-five may be promoted to the rank of lieutenant for acts of gallantry and daring will be extended to chief and other artificer engineers, who will be eligible for the rank of engineer lieutenant under these conditions.

Their lordships decided to promote to the rank of lieutenant from April 1, 1903, sixty officers from the lists of chief gunners, chief boatwains, chief signal boatswains, and chief carpenters. Two chief artificer engineers will be promoted to the rank of engineer lieutenant as soon as they have reached one year's seniority in chief rank, and three further promotions will be made annually until April, 1908; after that date promotions will be made in such a manner that the number of engineer lieutenants thus advanced shall not exceed 1-25th of the total number of chief and artificer engineers until a total of thirty shall have been reached. Future vacancies will be filled as they arise. The total number of lieutenants, engineer lieutenants, and carpenter lieutenants to be promoted from warrant rank is fixed at 100. Officers of the chief gunners' and boatswains' lists, and of chief artificer engineer lists thus promoted will be styled lieutenants and engineer lieutenants respectively, and will be shown in the Navy List under those headings. Officers promoted from the carpenter branch will be styled carpenter lieutenants, and will be shown on a separate list. These officers will rank with lieutenants and with corresponding ranks of other branches according to their dates of seniority.

Sub-lieutenants and midshipmen will be employed in the duties of mates of decks, and the appointment of warrant officers for these duties will gradually cease. The alterations in the rank of engineer officers and the

scheme for utilising the services of officers of Royal Marines which came into force on April 1 are briefly dealt with, after which the circular proceeds:—Arrangements have been made for providing all the necessary means for giving practical sea-going instruction in engineering, navigation, and the other portions of an officer's duties to the cadets during their instructional course, and further careful consideration is being given to apportioning such time as is desirable to instruction in a seagoing training-ship, either during or towards the end of the first four years of the cadet's period of service. The experience in the Isis has shown the great value of such an arrangement—either during or subsequent to the cadet's course. Cadets failing to qualify by satisfying the test of progress at the end of each of the first four years, or judged for any reason to be unsuitable, will be withdrawn from the service.

Further careful examination will be given to the question of the courses of instruction at Greenwich, Portsmouth, and Keyham, when cadets reach sub-lieutenant's rank with the view of making a more effective use of the time to be spent at those shore establishments. It is hoped to obviate the necessity that exists under present arrangements for devoting so much time to these courses of instructions, which have the ill effect of congregating a very large body of young officers at shore establishments for a lengthened period at a time of their service which would be more profitably spent at sea. The question of shortening the present long period of instruction of officers qualifying for gunnery and torpedo lieutenants is being carefully looked into. It is also intended to rearrange the regulations for the instruction of navigating officers, so that a definite course of practical training may be given them in an instructional sea-going ship, and such other arrangements made as will enable navigating officers to be more eligible than at present for appointment as first-lieutenants in association with their navigating duties. The effect of these modifications of the courses for sub-lieutenants at Greenwich, Portsmouth, and Keyham, will add considerably to these officers' seagoing time as sub-lieutenants and will be a most desirable improvement in the scheme of training.—*United Service Gazette.*

Changes in the Armament of Warships.—One of Sir William White's *Times* articles dealt with the additions now being made to the armaments of our warships. These additions are sometimes not even known to the majority of people (the Mersey is a case in point), and in a general way very hazy ideas prevail as to what foreign navies have done in the same direction. The information can, indeed, only be acquired by looking up a considerable number of scattered data, and even then much cross reference is required.

We have therefore collected every single reconstruction or re-armament effecting displacement, and reduced the whole into a convenient form for reference; such a table seeming likely to be of particular interest at the present moment, when the Naval Estimates are being discussed.

We have omitted a few old ships no longer in service, or likely soon to disappear, such as the Rupert, Hotspur, and Monarch. We may, however, mention that the Rupert, which had two 22-ton breech-loaders substituted for two 18-ton muzzle-loaders, was as dismal a failure as the Bellerophon (the first ship we re-armed). The net increase of weight one way and another was nearly 200 tons, and this sufficed to submerge the ship to an unexpected extent, so much so that she has never since been able to take her proper coal supply on board. It is due to the failures with the Bellerophon and Rupert (due in each case, we believe, to a disregard of the increased weight of gun mountings) that for some time reconstruction has not been popular in the British navy.

We have included in the list many minor powers because, in the majority of cases, the re-armament of the ships of such powers has been of a very complete nature. We have marked with an asterisk such ships as are not yet actually in hand for the contemplated changes.—*Engineer.*

CHANGES IN THE ARMAMENT OF WARSHIPS.

Nation.	Name.	Designed displacement.	Net increase or decrease of weight.	Original armament.	Present or new armament.	Other changes and notes.
		Tons.	Tons.			
British	Trafalgar	11,940	+ 40	Four 13·5, six 4·7 Q. F.	Six in. 40 cal. Q. F., substituted for the 4·7's.	Some torpedo tubes removed. New mast added.
"	Nile					
"	Royal Sovereign	14,200	+ 100	Four 13·5, ten 6-in.	As before.	Six new upper deck casemates placed. Four above-water torpedo tubes removed. Seaworthiness deteriorated by the 100 tons extra top hamper.
"	Empress of India					
"	Ramillies*					
"	Royal Oak					
"	Repulse					
"	Resolution					
"	Revenge					
"	Hood*					
"	Centurion	*Was* 10,500	+ 150 *probably.*	Four 10-in., ten 4·7 in.	Four 10-in. (as before), 10 6-in. (45 calibre).	Six new casemates. Above-water tubes removed. New Boilers. Rig reduced. Two gun positions lowered.
"	Barfleur					
"	Powerful	14,200	+ 100	Two 9·2, twelve 6-in.	Four *extra* 6-in. *added.*	Four new casemates added.
"	Terrible*					
"	Diadem*	11,000	?	Sixteen 6-in.	Four *extra* 6-in. *to be added.* Possible removal of two guns now unprotected.	Four new casemates to be added.
"	Andromeda					
"	Europa*					
"	Spartiate*					
"	Argonaut*					
"	Ariadne*					
"	Niobe*					
"	Amphitrite*					
"	Cressy*	12,000	+ 100	Two 9·2, twelve 6-in.	Four *extra* 6-in. *to be added.*	Four new casemates to be added.
"	Aboukir*					
"	Hogue*					
"	Sutlej*					
"	Euryalus*					
"	Bacchante*					
"	Camperdown	10,600	No change.	Four 13·5, six 6-in. (converted).	Six modern 6-in. *substituted* for the old ones.	Extra weight of new guns compensated for by the bare charges.
"	Howe	10,300				
"	Arrogant	8,780	Less than 100 tons.	Four 6-in. (40 cal.), six 4·7-in.	Ten 6-in. (45 cals.).	New guns have no brass cartridge cases.
"	Furious					
"	Gladiator*					
"	Vindictive*					
"	Minerva*	5,600	Less than 100 tons.	Five 6-in. (40 cal.), six 4·7-in.	Eleven 6-in. (45 cals.).	New guns have no brass cartridge cases. Talbot is without fighting tops; other may lose theirs.
"	Diana*					
"	Juno*					
"	Venus*					

CHANGES IN THE ARMAMENT OF WARSHIPS.—Continued.

"	Camperdown	10,600	No change.	Four 13·5, six 6-in. (converted).	Six modern 6-in. *substituted* for the old ones.	Extra weight of new guns compensated for by the bare charges.
"	Howe	10,300				
"	Arrogant	5,750	Less than 100 tons.	Four 6-in. (40 cal.), six 4·7-in.	Ten 6-in. (45 cals.).	New guns have no brass cartridge cases.
"	Furious					
"	Gladiator*					
"	Vindictive*					
"	Minerva*	5,600	Less than 100 tons.	Five 6-in. (40 cal.), six 4·7-in.	Eleven 6-in. (45 cals.).	New guns have no brass cartridge cases. Talbot is without fighting tops; other may lose theirs.
"	Diana*					
"	Juno*					
"	Iphi*					

CHANGES IN THE ARMAMENT OF WARSHIPS.—Continued.

Nation.	Name.	Designed displacement.	Net increase or decrease of weight.	Original armament.	Present or new armament.	Other changes and notes.
		Tons.	Tons.			
British	Eclipse	5,600	Less than 100 tons.	Five 6-in. (40 cal.), six 4.7-in.	Eleven 6-in. (45 cals.).	New guns have no brass cartridge cases. Talbot is without fighting tops; other may lose theirs.
"	Talbot*					
"	Dido					
"	Isis					
"	Mersey	4,050	*Very little net change.*	Two 6-in. (old), ten 6-in. (old).	Twelve 6-in. (45 cal.).	Torpedo tubes removed.
"	Aurora	5,600	*Slight reduction.*	Two 9·2 (old), ten 6-in. (old).	In some, 6-in. (45 cal.) have been mounted.	Torpedo tubes removed.
"	Australia					
"	Narcissus					
"	Immortalité					
"	Orlando					
"	Undaunted					
"	Galatea					
"	Thunderer	9,330	?	Four 38-ton M. L.	Four 10-in. B. L.	Submerged tubes added to Devastation.
"	Devastation					
"	Bellerophon	*Was* 7,550	*Great increase.*	Ten 9-in. (12-ton M. L.), four 6-in. (old M. L.)	Ten 8-in. (old 15-ton B. L.), four 6-in. (old B. L.), six 4-in. (old B. L.)	Ship submerged at least two extra feet.
"	Alexandra	9,490	?	Two 11-in. (25-ton M.L.), ten 10 in. (18-ton M.L.), *to which* six 4-in. (1-ton B. L.) were added.	Four 22-ton B. L., eight 18-ton M. L. (these as before), six 4.7 (45 cal.) Q. F.	No deterioration to speed or stability.
"	Superb	9,170	Some increase.	Sixteen 18-ton M. L., six 4-in. (1-ton B. L.)	Twelve 18-ton M. L. (as before), ten 6-in. Q. F.	No effect on the ship.
"	Renown	12,350	Weights moved.	Four 10-in., ten 6-in., twelve 12-pdrs.	As before.	The fore and aft 12-pdrs. placed a mast bases on flying deck. Extra very high topmasts added. After bridge removed. New bridge fitted abaft fore bridge.
"	Drake	14,100	Bow lightened (in progress).	Two 9·2, sixteen 6-in., fourteen 12-pdrs.	Four forward 12-pdrs. removed, to be placed elsewhere if possible.	Bow wave enters fore 12-pdr. ports and swamps decks. These are therefore being sealed up.
"	Leviathan					
"	Good Hope					
"	King Alfred					
"	St. George	7,700	+ 100	Two 9·2, ten 6-in. (Mark II.).	Two 9·2 (as before), ten 6-in. Mark VII.	Six new casemates on upper deck. New guns take bare charges. Above-water torpedo tubes removed.
"	Edgar*	7,350				
"	Endymion*					
"	Gibraltar*	7,700				
"	Hawke*	7,350				
"	Theseus*					
"	Grafton*					
"	Crescent*	7,700	+ 100	One 9·2, twelve 6-in. (Mark II.)	One 9·2, twelve 6-in. Mark VII.	Ditto.
"	Royal Arthur*					

CHANGES IN THE ARMAMENT OF WARSHIPS.—Continued.

Nation.	Name.	Designed displacement.	Net increase or decrease of weight.	Original armament.	Present or new armament.	Other changes and notes.
		Tons.	Tons.			
France	Baudin, Formidable	12,165	+ 785	Three 14·5 (75-ton), four 6·4, eight 5·5 (3-ton).	Two 10·8 (34-ton), eight 6·4, ten 5·5-in.	Armored battery substituted for amidship barbette. New turrets for big guns. Rig reduced.
"	Neptune, Magenta, Marceau	*About* 10,850	Expected reduction.	Four 13·4 (52-ton), seventeen 5·5 (3-ton).	Two 12-in. (46-ton), eight 6·4-in., *lighter guns not decided.*	Four barbettes removed. Six turrets substituted. Rig altered. New boilers (w. t.) and machinery.
"	Hoche	10,800	— 100 or more.	Two 13·4 (52-ton), two 10·8 (23-ton), eighteen 5·5-in. (3-ton), (old).	Six 5·5 *removed.*	Rig and superstructure reduced.
"	Courbet	10,200	Slight reduction.	Four 13·4 (48-ton), four 10·8 (23-ton), six 5·5 (3-ton), old.	Four 10.8 (12-ton, new), three 9·6, one 6·4, ten 4-in.	Re-boilered (w. t.). Heavy shields to the new 10·8 guns. Rig reduced.
"	Devastation	10,200	— 500 or more.	Four 12·6, old (48-ton), four 10·8 (23-ton), six 5·5 (3-ton), old.	Four 10·8 (28-ton), two 9·6, ten 4-in.	Re-boilered (w. t.). Shields to new 10·8. Rig reduced.
"	Redoubtable	9,500	Some increase.	Eight 10·8 (24-ton), six 5·5 (3-ton).	Four 10·8 (28-ton new), four 9·6 (new), six 4-in.	Re-engined. Rig increased.
"	Requin, Indomptable, Caiman	*About* 7,000 *now*	— 600	Two 16·5 (75-ton), four 4-in.	Two 10·8 new model, six 4-in.	Turrets substituted for barbettes. Re-boilered (w. t.). Two torpedo tubes removed.
"	Furieux	6,000	Slight reduction.	Two 13·4 (48-ton).	Two 9·4 new model.	Turrets for barbettes. Re-boilered (w. t.).
"	Sfax	Now 4,728	+ 226	Six 6·4 (5-ton), ten 5·5 (3-ton).	Six 6·4 (7-ton), ten 5·5 (4-ton).	Rig reduced.
Russia	Nakhimoff	About 8,000	Little change.	Eight 8-in. (old), ten 6-in. (old).	Eight 6-in. (new), ten 4·7 (new).	Rig reduced. Re-boilered. Speed much *increased.*
"	Pamiat Azova	6,700	+ 300, about.	Two 8-in. (old), twelve 6-in. (old).	Fourteen 6-in. (new).	Rig reduced.
"	Vladimir Monomakh	6,000	Reduced.	Four 8-in., twelve 6-in. (all old).	Five 6-in. (new), six 4·7 (new).	Rig reduced. New engines, &c.
"	Dmitri Donskoi	5,880	Increase not known.	Two 8-in., twelve 6-in. (all old).	Six 6-in. (new), ten 4·7 (new).	New engines, &c. Old heavy rig much reduced.
"	Admiral Korniloff	8,880	+ 75	Fourteen 6-in. (old).	Fourteen 6-in. (new).	.....
Germany	Brandenburg*, Woerth*, Kurfurst Friedrich Wilhelm*, Weissenbourg*, Victoria Louise	10,040	To counterbalance.	Four 11-in. (long), two 11-in. (short), six 4-in., eight 3·4-in.	Four 11-in. (long), ten 6-in., *probably.*	Amidship barbette removed, and battery for Q. F. substituted. Submerged instead of above-water tubes.
"	Prinz	6,660	+ 10	Two 8-in., eight 6-in., 10 3·4.	Two *extra* 3·4 *added.*	.....

CHANGES IN THE ARMAMENT OF WARSHIPS.—Continued.

"	Dmitri Donskoi.....	6,880	Increase not known.	Two 8-in., twelve 6-in. (all old).	Six 6-in. (new), ten 4·7 (new).	New engines, &c. Old heavy rig much reduced.
"	Admiral Kornilloff....	6,880	+ 75	Fourteen 6-in. (old).	Fourteen 6-in. (new).	.....
Germany	Brandenburg*	10,040	To counterbalance.	Four 11-in. (long), two 11-in. (short), six 4-in., eight 3·4-in.	Four 11-in. (long), ten 6-in., *probably*.	Amidship barbette removed, and battery for Q. F. substituted. Submerged instead of above-water tubes.
"	Woerth*					
"	Kurfurst Friedrich Wilhelm*					
"	Weissenbourg*					
"	Victoria Louise	6,660	+ 10	Two 9-in., eight 6-in., 10 3·4.	Two extra 3·4 added.	.....

CHANGES IN THE ARMAMENT OF WARSHIPS.—Continued.

Nation.	Name.	Designed displacement.	Net increase or decrease of weight.	Original armament.	Present or new armament.	Other changes and notes.
		Tons.	Tons.			
Germany	Sachsen.....	7,400	Little change.	Six 10·2 (old) (18-ton), four 4-in.	Six 10·2 (old), eight 3·4.	New engines. New boilers. Submerged torpedo armament added. Old guns retained, as new could not be carried.
"	Baden					
"	Baiern.....					
"	Würtemburg.....					
"	Hagen	*Now* 4,114	+ 614	Three 9·4-in., eight 3·4-in. (Siegfried only six).	Two extra 3·4 *added*.	Ships lengthened. 275 extra tons coal. New engines. New boilers (w. t.). New torpedo armament. New and heavier conning tower (7-in. instead of 3-in.)
" ...	Siegfried.....					
"	Heimdall					
"	Hildebrand.....					
"	Frithjof.....					
"	Beowulf.....					
Italy.....	Dandolo	*Nominal* 11,200 *originally*	+ 1,000, about.	Four 17-in. (100-ton M. L.), three small guns.	Four 10-in. (new), seven 6-in. (32 cals.), five 4·7 (35 cals.).	New boilers, new engines, new turrets. Coal supply reduced to mitigate increased displacement. Steams well.
"	Five old Italian iron clads also re-armed, but only as harbor-defence ships, therefore not given here.					
United States	Chicago	*Now* 5,000	+ 500	Four 8-in., eight 6-in., two 5-in. (all old).	Four 8-in. (35 cals.), fourteen 5-in. (40 cals.).	New boilers (w. t.), new machinery, new armour deck. Torpedo tubes removed. Rig much reduced.
"	Newark.....	*Now* 4,098	+ 15	Twelve 6-in. (old).	Twelve 6-in. (40 cals.).	Torpedo tubes removed, and various slight internal modifications.
"	S. Francisco.....					
"	Baltimore.....	*Now* 4,600	+ 187	Four 8-inch. (old), (12-ton), six 6-in. (5-ton).	Ten 6-in. (converted).	.....
"	Cincinnati	*Now* 3,213	+ 30	One 6-in., ten 5-in.	Eleven 5-in. (latest model).	Rig reduced. Torpedo tubes removed.
"	Raleigh					
"	Atlanta	3,189	*No change.*	Two 8-in. (old 12-ton), six 6-in. (old 5-ton).	Guns converted to Q. F.	Rig reduced. Re-boilered (w. t.) Torpedo tubes removed.
"	Boston.....					
Japan	Fuji	12,500	*Trifling.*	Four 12-in., ten 6-in.	Sixteen 12-pdrs. *substituted* for 6-pdrs.	.....
"	Yashima.....					
"	Chin Yen.....	7,350	*About* + 50	Four 12-in. (old), two 6-in. (old).	Four 12-in. (old), four 6-in. (40 cals. new).	Old stern turret removed. Alterations to superstructure.
"	Fuso.....	3,717	*No change.*	Four 10-inch (15-ton Krupp), two 6·7-in. (6-ton Krupp).	Eight 6-in. (40 cal. new).	Rig reduced.
"	Idzumi (*ex* Esmeralda)	3,000	*Reduction of weight.*	Two 10-inch (15-ton Krupp), six 6-in. (old).	Two 6-in. (40 cal.), six 4·7 (45 cal.).	Rig reduced.

CHANGES IN THE ARMAMENT OF WARSHIPS.—Continued.

Nation.	Name.	Designed displacement.	Net increase or decrease of weight.	Original armament.	Present or new armament.	Other changes and notes.
		Tons.	Tons.			
Japan	Naniwa	3,709	*About* + 40	Two 10-inch (18-ton Krupp), six 6-in. (old Krupp).	Six 6-in. (40 cal.) *substituted* for old 6-in.	Fighting tops lowered.
"	Takachiho					
Austria	Teggetthoff	7,400	*Increase not known.*	Six 10-in. (old Krupp), six 3·7-in. (old).	Six 9·4, five 6-in.	Re-engined. Re-rigged.
Spain	Pelayo	9,950	+ 50, *perhaps more.*	Two 12·6, two 10·8, one 6·4, twelve 4·7-in.	Two 12·6, two 10·8 *as before*, nine 5·5 (new Canet).	Armored battery added. Re-boilered (w. t.).
"	Two old Spanish iron clads re-armed for service in harbors only, and so not given here.					
Sweden	Göta	3,300, *about*	*Not known.*	Two 10-in., four 6-in. (Svea has temporarily four 4·7 Q. F. instead of four old 6-in. B. L.)	One 8-in., seven 6-in. (all new Bofors).	Entire upper part altered. Turrets instead of battery for 6-in.
"	Thule					
"	Svea*					
"	Oden	3,400	*About* + 12	Two 10-inch, four 4·7-in.	Two *extra* 4·7 *added.*	Alterations in battery.
"	(Some Swedish and Norwegian monitors have also been re-armed, &c.					
Turkey	Messoudiyeh	Formerly 9,120	*Not known.*	Twelve 10-in. (18-ton M. L.), three 7-in. (6-ton).	Two 9·2, twelve 6-in., fourteen 3-in. (all Vickers).	Upper part entirely altered. Re-boilered (w. t.). Re-engined. Hull re-shaped. Speed much increased.
Argentina	Almirante Brown	4,200	*Reported great increase.*	Eight 8-in. (12-ton), six 4·5-in.	Ten 6-in., four 4·7 (all new Canet, 50 calibres).	.....
Portugal	Vasco da Gama	2,422	*Not known.*	Two 10·2-in. (18-ton Krupp), two 6-in (old), three old 40-pounder Armstrong.	Four 8-in., four 4·7.	Complete reconstruction; data not yet available.
Brazil	Aquidaban	*About* 5,000	*Slight increase.*	Four 9-in. (20-ton), four 5½-in. (5-ton).	Four 8-in. (Elswick (Q. F.), four 4·7 (50 calibres).	Heavy military rig given.
"	Riachuelo	5,700	*Considerable increase.*	Four 9-in. (20-ton), six 5½-in.	Six 4·7 (45 cal. Elswick) *substituted* for old 5½-in.	Heavy military rig given.
Greece	Psara	5,000	*Increase about* + 59	Three 10·8, five 6-in.	Five 6-in. Q. F. replace old 6-in., one 4-in. and eight 9-pdrs. added.	Rig altered.
"	Hydra					
"	Spetsai					

It should, perhaps, be noted, in conclusion, that a warship rarely floats at the designed displacement, that estimated being frequently exceeded by as much as 10 per cent. Thus, the Hood is something like 15,400 actually, and the Diadem class nearer 12,000 than 11,000; this tends to make a small addition quite an easy thing. Since the Admirals and Orlandos no British ships—except, perhaps, the Drake class—have been unduly submerged by excess of displacement; but French ships—notably the Requin class—have suffered badly on this account. This is the reason why so many French re-constructions represent a marked decrease of weight. In the United States navy it is usually the practice to give the actual instead of the designed displacement.

To make the above list absolutely complete, mention must be made of the fact that the British County class has had the after bridge done away with, masts much lowered, and there is talk of reducing the height of the funnels. In several Italian ships 12-pounders are to replace 3-pounder guns.

In the French navy some new ships have been re-designed (Renan, &c.), and guns removed in order to give increased speed at the expense of gun fire.

ITALY.

VESSELS BUILDING.

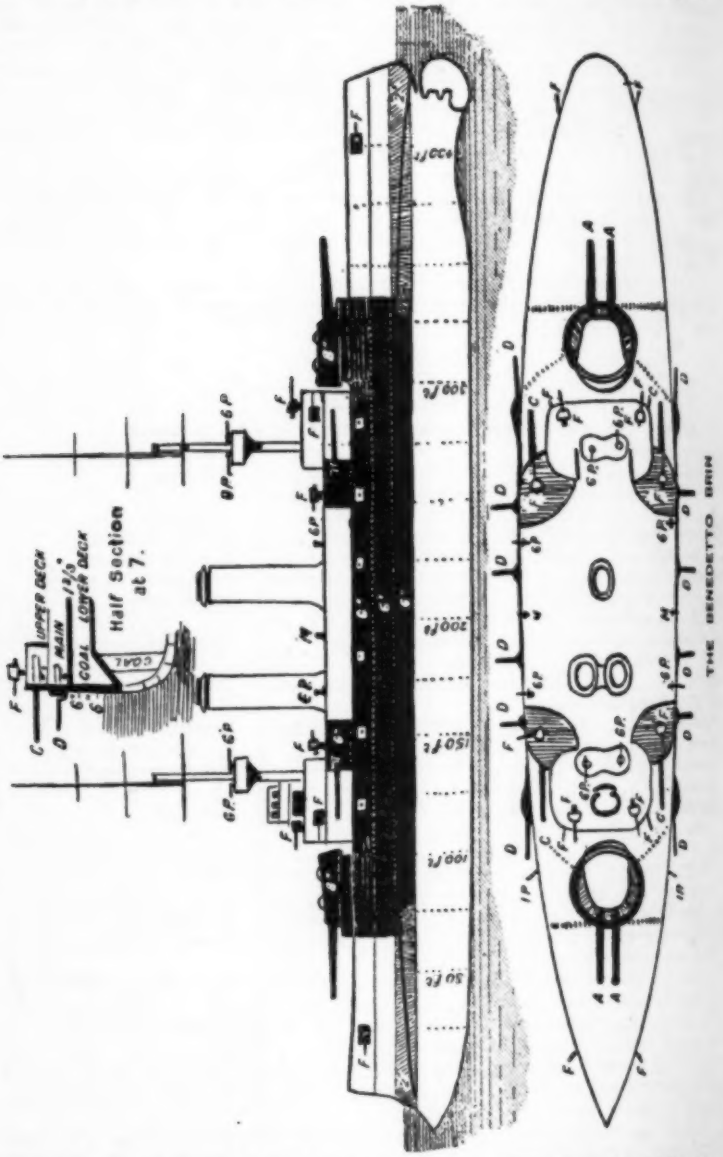
Name.	Displacement.	Where Building.	Remarks.
Battleships.			
Roma	12,625	Gov't Yard, Spezia.	Building.
Napoli	12,625	Gov't Yard, Castellamare.	"
I	12,625	Gov't Yard, Venice.	Projected.
Vittorio Emanuele	12,625	Gov't Yard, Spezia.	Not yet launched.
Regina Elena	12,625	Gov't Yard, Castellamare.	Not yet launched.
Benedetto Brin	13,526	Gov't Yard, Castellamare.	Launched Nov. 7, 1901.
Regina Margherita	13,526	Gov't Yard, Spezia.	Under trial.
Armored Cruiser.			
Francesco Ferruccio	7,460	Gov't Yard, Venice.	Launched April 30, 1902.
Torpedo Cruiser.			
Coatit	1,313	Gov't Yard, Castellamare.	Under trial.
Torpedo Boat Destroyers.			
Aquilone	350	C. T. T. Pattison, Naples.	Launched Oct. 16, 1902.
Borea	350	" " "	Launched Feb., 1903.
Meteoro	350	" " "	Not yet launched.
Tuono	350	" " "	" " "
Espero	350	" " "	Building.
Zefiro	350	" " "	"

THE ITALIAN FIRST-CLASS BATTLESHIP BENEDETTO BRIN.—The Benedetto Brin and her sister, the Regina Margherita, made such a sensation when a few years ago, they were first announced, that it is difficult to realize that they are not yet complete. It will, however, be some time still before they are in commission.

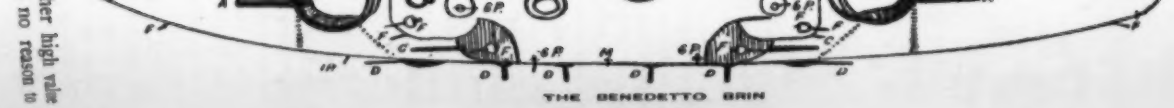
Like all Italian warships of size, except the St. Bons and the antiquities of the Ruggiero di Lauria era, the Benedetto Brin is an "intermediate." In theory she, belonging to that class. is something stronger than an armored cruiser, and somewhat weaker than a battleship, but there is a good deal more theory than practice in the matter when she is compared with many battleships, for she is better than many, and certainly fully equal to any of her own size.

Below we tabulate the particulars of the Benedetto Brin, first with battleships of her size and era, secondly with cruisers of about the same size and date. For comparison's sake we might have inserted the Duncan though it is hardly fair to the Brin's designer to do so, since though

completed earlier, she represents a later stage in conception. Some may incline to think that the later stage fails to exhibit much in the way of advantage, but that must not be too definitely assumed until the Bene-



detto Brin has proved what she can do at sea. Till then her high value is, to a certain extent, a "paper" one, though we have no reason to believe that she will fail.



THE BENEDETTO BRIN

COMPARISON TABLE OF WARSHIPS.

	B. Brin.	Canopus.	Suffren.	Maine.	E. P. Tavritchesky.	Wittelsbach.
Power	Italy.	England.	France.	United States of America.	Russia.	Germany.
Displacement	13,427	12,950	12,728	12,300	12,500	11,800
Length	426 ft. p.p.	390 ft. p.p.	410 ft.	388 ft. p.p.	371 ft.	416½ ft.
Beam	78 ft.	74 ft.	70ft.	72 ft.	72½ ft.	67ft.
Draught	27¼ ft. mean	26¾ ft.	27½ ft.	24 ft. mean.	27 ft. mean.	28 ft.
Guns—A.	Four 12-in.	Four 12-in.	Four 12-in.	Four 12-in.	Four 12-in.	....
B.	....	....	....	....	....	Four 9·4-in.
C.	Four 8-in.	....	....	....	....	....
D.	Twelve 6-in.	Twelve 6-in.	Ten 6-in.	Sixteen 6-in.	Sixteen 6-in.	Eighteen 6-in.
	Sixteen 12-pdrs.	Ten 12-pdrs.	Eight 4-in.	Six 14-pdrs.	Fourteen 12-pdrs.	Twelve 3·4-in.
	Eight 6-pdrs.	Six 3-pdrs.	Two 9-pdrs.	Eight 6-pdrs.	Twenty 1-pdrs.	Twelve 1-pdrs.
	Two 1-pdrs.	Eight machine.	Twenty 3-pdrs.	Six 1-pdrs.		Eight machine.
	Two Maxims.		Two 1-pdrs.	Six machine.		
Torpedo tubes	Four submerged.	Four submerged.	Two submerged.	Two submerged.	Three submerged.	Five submerged.
			Two above water.		Two above water.	One above water.
Belt	6-in.—2-in.	6-in.—2-in.	12-in.—6-in.	12-in.—4-in.	9-in.—7-in.	9-in.—4-in.
Ratio to length	Complete.	Three-quarters.	Complete.	Three-quarters.	Half.	Complete.
Deck	3¼-in. inclined.	2½-in.	3-in. flat.	4-in. aft, 3-in. inclined.	4-in. inclined.	3-in. inclined.
Lower deck side	6-in.	6-in.	5in.—2in.	6-in.	6-in.	5½-in.
Ratio to length	Half.	Half.	Three-quarters.	Half.	Half.	Half.
Barbettes	8-in.	12-in.	12-in.	12-in.—8-in.	10-in.	10-in.
Barbette hoods	8-in.	8-in.	10-in. turrets.	12-in.	12-in.	10-in.
Battery	6-in.	....	6-in.	6-in.	5-in.	5½-in.
Casemates	6-in.	5-in.	5-in. turrets.	6-in.	5-in.	6-in. turrets.
Indicated horse-power	19,000	13,500	16,200	16,000	10,000	14,000
Speed	20 knots.	18·25 knots.	18 knots.	18 knots.	17·5 knots.	18 knots.
Normal coal, tons	1200 + oil.	1000	820 + oil.	1000	670 + 600 oil.	653 + 200 oil.
Maximum coal, tons	2070 + oil.	2300	1150 + oil.	2000	870	1400.
Boilers	Belleville.	Belleville.	Niclausse.	Niclausse.	Belleville.	Schulz and cylindrical.
Screws	2	2	3	2	2	2

COMPARISON TABLE OF WARSHIPS.—Continued.

	B. Brin.	Drake.	Renan.	Gambetta.	California.	Pobieda.	Gromovoi.
Power	Italy.	England.	France.	France.	United States of America.	Russia.	Russia.
Displacement	13,427 m. t.	14,100	About 13,000	12,416	13,400	12,670.	12,367.
Length	426 ft. p. p.	500 ft.		476 ft.	502 ft.	436 ft.	47½ ft.
Beam	78 ft.	71 ft.	Not definitely known	71 ft.	70 ft.	71½ ft.	69 ft.
Draught	27½ ft. *mean.*	26 ft. *mean.*		26½ ft. *mean.*	26½ ft.	21½ ft.	29½ ft.
Guns—A	Four 12-in.	....	....	....	....	....	....
B	....	Two 9.2-in.	Two 9.4-in.	....	....	Four 10-in.	....
C	Four 8-in.	....	....	Four 7.6-in.	Four 8-in.	....	Four 8-in.
D	Twelve 6-in.	Sixteen 6-in.	Twelve 6.4-in.	Sixteen 6.4-in.	Fourteen 6-in.	Eleven 6-in.	Sixteen 6-in.
E	....	....	....	....	....	.. .	....
F	Sixteen 3-in.	Fourteen 3-in	....	....	Eighteen 3-in.	Twenty 3-in.	Twenty 3-in.
Minor	Eight 6-pdrs. Two 1-pdrs. Two Maxims.	Three 3-pdrs. Eight machine.	*Uncertain.*	Twenty-two 3-pdrs. Two 1-pdrs.	Twelve 3-pdrs. Eight 1-pdrs. Eight machine, &c.	Twenty-six smaller.	Sixteen 3-pdrs. Eight smaller.
Torpedo tubes, submerged	Four.	Two.	Two.	Two.	Two.	Two.	Two.
Torpedo tubes, above water	....	....	Three (?)	Three.	....	Four.	Two.
Armor—							
Belt	6-in—2-in.	6-in.—3-in.	6-in.—3-in.	6-in.—4-in.	6 in.—3½-in.	9-in.—4-in.	6-in.—4-in.
Ratio to length	Complete	Three-quarters.	Nearly complete.	Practically complete.	Complete.	Complete.	Three quarters.
Lower deck side	6-in.	6-in.—3-in.	5-in.—2-in.	5-in.—3-in.	5-in.	5-in.	4-in.
Ratio to length	Half	Three-quarters.	Nearly complete.	Nearly complete.	One-third.	One-third.	One-fifth.
On big guns	8-in.	5-in.	*Not known.*	6-in.	6-in.	9-in.	6-in. and nothing.
Big gun bases	8-in. barbettes	6-in. (and tubes).	....	5-in. big tubes.	6-in. (and tubes)	8-in.	5-in.
On secondary guns	6-in.	6-in.	5-in.	6-in. and 4-in.	5-in. and 6-in.	5-in.	5-in.
Armor deck	3½-in.	4-in.	2-in.	2½-in.	4-in.	2½-in.	2-in.
Indicated horse-power	19,000	30,000	33,000	27,000	23,000	?	18,000
Maximum speed	20 knots.	24 knots.*	23.5 knots.	22 knots.	22 knots.	18 to 19 knots.	20 knots.
Normal coal, tons	1,200	1,250	*Not settled.*	1,320	900	1000	800
Maximum coal, tons	2,000	2,500		2,100	2000	2000	2500
Oil	Carried.	None.	Carried.	Carried.	None.	Carried.	Carried.

* The Drake class can do 24 knots with their new propellers, though nominally they are 23-knot ships.

The Canopus to a certain extent antedates the Brin, and is, perhaps, the *motif* of her. That is to say, the Brin was envolved with the idea of producing something better, and, with a single sacrifice, that "something better" would appear to have been secured all along the line.

Now, looking at the comparison of battleships, especially as concerns the Canopus and Benedetto Brin, we observe a difference of displacement of 477 tons, though, as the Brin's weights are in metric tons, the exact difference is only about 250 tons, the Brin's displacement in English tons being approximately 13,200. In the ordinary way, the difference between metric and English tons may be neglected; but in a close comparison, such as we propose to institute, more exactness than usually suffices will be required. This 250 tons is the minimum excess of coal or oil carried by the Brin, assuming her to carry 50 tons odd of oil only—whereas she more probably carries nearer 200 tons. Still, the Canopus has a fine supply of unnecessary stores as a make-weight; we will therefore take it that the Brin's extra displacement is swallowed in fuel. The problem then confronting us is as follows:—

Pro.	*Con.*
Four 8-in. extra.	4-in. less on barbettes.
Two 6-in. extra.	
Six 12-pounders extra.	
Eight 6-pounders against six 3-pounders.	
1-in. more on secondary guns.	
1.75 knots more speed.	
5500 more indicated horse-power.	

The belt aft may be neglected, for the Brin's thin belt is little better than the Canopus' double skin, which appears as 1½ inch armor in the official plans. Of neither ship is the exact weight of armor to be obtained, but in view of the fact that the Brin has a larger area covered, it is extremely doubtful whether she carries any less weight than the Canopus. In guns and mountings she consumes something like 150 tons more, though she may make up here by carrying less amunition. Thus far, then, things can be explained; but how is the Brin's superior engine power, certainly a great excess of weight, to be accounted for? Sir William White, in the *rôle* of apologist for official design, was, justly enough, indignant at comparison between the Renown and Vittorio Emanuele. Between these ships a great gulf of date exists, an interim in which naval architects are supposed to have grown in wisdom. But between the Canopus and Benedetto Brin design there is no such gulf. We are left wondering, therefore, why the Canopus was not a 20-knot ship. Either, as we have on a previous occasion remarked, the Canopus is crammed with useless stores, or else the authorities have been allowed to follow an ostrich-like policy. There is a fear of setting the pace too fast at headquarters, and it is a well known fact that the Drakes and Cressies were given but two submerged tubes in the hope that foreign navies would copy, and naval warfare be simplified to a certain extent accordingly. It is rather ludicrous, but it actually bore some fruit. Possibly it was felt that an 18.25 knot Canopus would keep other powers from thinking anything faster desirable, and so ships like the Majestic class be given a longer lease of useful life.

However we may elect to regard it, we are left facing the fact that the Brin is altogether the better ship in every detail save one—the protection to the big guns. Nor does the heavier Duncan look much better against her. She has an inch more belt, and it runs nearly to the bow, but her speed is still a knot less.

Against the other battleships the Benedetto Brin does not look so well, by reason of her cruiser belt against the double thickness of the Maine and Suffren's water-line, or the 9-inch of the Kniaz Potemkin Tavritchesky

* The Drake class can do 24 knots with their new propellers, though nominally they are 22-knot ships.

and the Wittelsbach. Save against the Suffren, she is not much better gunned, and her superiority rests in speed alone. Compared to these battleships she is an armored cruiser with a battleship's guns—the ideal, no doubt, of her design.

Reducing the broadside to units of 12-pounders, value one, with the 6-inch at four, big guns at eight, and other guns *pro rata*—a fair test for shell fire value—the ships stand thus:—

(1)	B. Brin	32 + 12 + 24 + 8	= 76
	Wittelsbach	32 + 0 + 32 + 8 (3·4-in.)	= 76
(3)	K. P. Tavritchesky	32 + 0 + 32 + 7	= 71
(4)	Maine	32 + 0 + 32 + 3	= 67
(5)	Canopus	32 + 0 + 24 + 5	= 61
(6)	Suffren	32 + 0 + 20 + 5 (4-in.)	= 57

In speed they come:—

		Knots.
(1)	Brin	20
(2)	Canopus	18·25
(3)	Suffren	18
	Maine	18
	Wittelsbach	18
(6)	K. P. Tavritchesky	17·5

In armor protection:—(1) Maine; (2) Suffren; (3) Wittelsbach; (4) K. P. Tavritchesky; (5) Canopus; (6) Benedetto Brin.

In coal supply, normal:—(1) B. Brin, 1200 tons + oil; (2) Canopus and Maine, 1000 tons; (4) Suffren, 820 tons + oil; (5) K. P. Tavritchesky, 670 tons + oil; (6) Wittelsbach 653 tons + oil.

In handiness:—(1) Canopus: (2) Wittelsbach; (3) Maine; (4) B. Brin; (5) Suffren and K. P. Tavritchesky.

In penetrative power:—(1) Benedetto Brin; (2) Maine and Canopus; (4) K. P. Tavritchesky and Suffren; (6) Wittlsbach.

Summarizing, we obtain:—

	Shell fire.	Speed.	Armor.	Coal.	Handiness.	Penetration.
Benedetto Brin	1	1	6	1	4	1
Maine	4	3	1	2	3	2
Canopus	5	2	5	2	1	2
Wittelsbach	1	3	3	6	2	6
Suffren	6	3	2	4	5	4
K. P. Tavritchesky	3	6	4	5	5	4

Which gives the Brin first place *quâ* battleship, supposing each quality of equal value, which is only very approximately true. Still, it is as true as we can get.

Thus for the Benedetto Brin as a battleship, or as a substitute for a battleship as generally understood.

Let us now for a moment consider her as a cruiser, comparing her with armored vessels of about the same displacement. From this comparison it will be seen that the Benedetto Brin, though slow against most cruisers, is as fast, or faster, than Russia considers necessary. In guns, of course, she is an easy first.

To return to a description of the Benedetto Brin. It will be at once noted that she differs very considerably from the Benedetto Brin that appears in naval annuals. The stern has been built up, and the battery guns re-disposed, so that four have an axial fire. Originally the 8-inch guns were to have been in turrets, now they are in casemates, which, being free from the risk of jams, are better than small turrets. But for this feature she closely resembles the British King Edward in the arrangement of her guns.

The armor deck reinforces the belt throughout, and it is topped along the main deck by a second—flat—deck 1⅔ inches thick.

The conning tower is only 6 inches thick, but this may be increased.

All the armor is on the Terni system, which has a figure of merit of three, or thereabouts, compared to iron armor.—*Engineer.*

The Italia Militare Marina describes the very successful results of the trials of the Italian armored cruiser Garibaldi, with all her twenty-four boilers in use, the ventilators closed, and one-third of the stockers new to the work. A force of 9400 horse-power was developed and maintained for over two hours, as compared with 9000 I. H. P. contemplated with natural draught, giving a speed of 18.6 knots. The full power is 13,500. The boilers are of the Niclausse type, and answered splendidly, there being no trouble during the whole of the trial, and the engines worked very smoothly. Niclausse boilers have been adopted for the Francesco Ferruccio and Regina Margherita, and the success of the Garibaldi gave great satisfaction.—*Army and Navy Gazette.*

JAPAN.

VESSELS BUILDING.

Name.	Displacement.	Where Building.	Remarks.
Battleships.			
1, 2, 3.....	15,000	.....	To be built 1904–1909.
Armored Cruisers.			
1, 2, 3.....	9,900	.....	" " "
Protected Cruisers.			
3, 4.....	5,000	.....	" " "
Hitaka.....	3,470	Yokosuka.	Launched.
Tsuchima.....	3,470	Kure.	Building.
Otawa.....	3,000	Yokosuka.	"
Torpedo Boat Destroyers.			
Asashio.....	320	Thornycroft, England.	Under trial.
Kasumi.....	360	Yarrow, "	" "
Shiakumo.....	320	Thornycroft, "	" "
Akatsuki.....	360	Yarrow, "	" "
Asagiro.....	375	Yokosuka.	Building.
Harusame.....	375	"	Launched.
Hayatori.....	375	"	Building.
Murasame.....	375	"	Launched.

Messrs. John I. Thornycroft and Co. (Limited), of Chiswick, have received an order from the Japanese government for the construction of a shallow-draught river gunboat of the same type as the Woodstock and Woodlark, and the Argus and Vigilante, built by this company for the British and French governments. This vessel, which is intended for use in China, is to be fitted with Thornycroft screw-turbine propellers, and Thornycroft-Schulz boilers, and will have a speed of 15 miles an hour when fully loaded at a draught of 2 feet.—*United Service Gazette.*

According to the Tokio correspondent of the *Times,* the financial arrangement for the purposes of the Japanese naval increment will probably be as follows: Bonds to the amount of 6,000,000 yen will be floated annually, retrenchments of 1,000,000 yen will be effected in administrative expenses, and 4,500,000 yen will be deflected from railway outlays. Thus 11½ million yen will be obtained yearly for the ten-year naval programme, but the Diet may insist on extending the period.—*Army and Navy Gazette.*

The Yacht states that Japan has ordered in England, three 16,000 ton battleships of the King Edward VII type; and that during the year three 11,000 ton armored cruisers and two 5000 ton protected cruisers will be laid down in Japanese shipyards.

RUSSIA.

VESSELS BUILDING.

Name.	Displacement.	Where Building.	Remarks.
Battleships.			
.....	16,000	St. Petersburg.	Building. Complete 1903.
X	16,000	.....	Projected.
X	16,000	.....	"
X	16,000	.....	"
X	16,000	.....	"
ImperatorAlexanderIII.	13,516	St. Petersburg.	Launched Aug., 1901.
Borodino	13,516	"	Launched Sept., 1901.
Orel	13,516	"	Lchd. July, 1902; compl. 1904.
KniazSuvarof.....	13,516	"	Lchd. Sept., 1902; compl. 1904.
Slava	13,516	"	Building.
Tsarevitch	13,100	La Seyne.	Under trial.
X	12,500	Nicolaiev.	Building.
X	12,500	"	Ordered.
X	12,000	Sevastopol.	"
Coast Defence Iron Clad.			
Admiral Boutakof.....	6,000	St. Petersburg.	Building.
Protected Cruisers.			
Oleg	6,750	St. Petersburg.	Launched.
Kayul	6,750	Nicolaiev.	Launched.
Otchakof	6,750	Sevastopol.	Launched Oct., 1902.
X	6,000	St. Petersburg.	Building.
X	6,000	"	"
Boyarin.....	3,200	Copenhagen.	Under trial.
Kalgoula	3,200	Nicolaiev.	Building.
Almaz	3,200	St. Petersburg.	Launched.
Jemtchug	3,200	"	Building.
Izumrud.....	3,200	"	"
7	3,200	Dantzic (Schichau).	"
8	3,200	St. Petersburg.	Projected.
Torpedo Boat Destroyers.			
Baklan	350	St. Petersburg.	Building.
Bekase.....	350	"	"
Gorlitsa	350	"	"
Kulik	350	"	"
Perepel	350	"	"
Skvoreta	350	"	"
Strij	350	"	"
Chtchegol.....	350	"	"
Albatross	350	"	"
Drozd	350	"	"
Diatel.....	350	"	"
Bezuprechin	350	"	Launched, 1902.
Zhivoi	350	Nicolaiev.	Building.
Zhioulka.....	350	"	"
Ziatky	350	"	"
Zhiasky.....	350	"	"
Zavidni	350	"	"
Zavetni	350	"	"

The Special Commission of Naval experts, which has been debating the question of the best types of warships to be added to the Russian navy, has submitted its report to the Ministry of Marine. The two chief conclusions arrived at are the following: That no more cruisers of the 3000 and 6000-ton classes be built, but in their stead, first-class battleships of 6000 tons and upwards, heavily armored and armed, and of the highest

possible speed. The torpedo-boats, upon which the Russian Admiralty continues to place great reliance, are in future to be confined to two types, viz. that of the British-built Som for squadron rating, and that of the Skylon for coastwise defence. The new constructive programme is to be carried out exclusively in Russian yards.—*Engineer*, April 3.

We have already announced that two battleships of 12,000 tons are to be added to the Russian Black Sea fleet, to be laid down at Sebastopol and Nicolaieff. They will presumably be of the Kniaz Potemkine Tavritchesky class, that being the type adopted for the fleet of the inland sea. The machinery is to be built by private firms. Three other destroyers are also to be put in hand, being of the same type as the Zavidni and Zavetni, built at Nicolaieff, and more are contemplated. It is known that some twelve destroyers in hand at the Nevski Yard and at Abo are intend for the Far East. They belong to what may be called the S and R classes, and resemble the four S boats which proceeded from Kronstadt through the Dardanelles to Sebastopol. These boats are now undergoing modifications in their machinery, found to be necessary at their trials. During the last three or four years there has been a great increase in Russian activity in building boats of the class. The Sokol (now Prytki), constructed at Poplar, was the original type.—*Army and Navy Gazette*, May 23.

SPAIN.

VESSELS BUILDING.

Name.	Displacement.	Where Building.	Remarks.
Protected Cruisers.			
Reina Regente	5,372	Ferrol.	Building.
Isabel la Catolica	3,500	Canaca.	"

It is reported that a program of Spanish naval construction has been definitely established—it contemplates a fighting fleet made up of 12 battleships of 14,000 tons and 19 knots speed, 6 scouts, 80 torpedo-boats, 6 destroyers, 2 submarines, and 2 training ships of which one of 5000 tons, is specially designed for the instruction of machinists and firemen.

SWEDEN.

VESSELS BUILDING.

Name.	Displacement.	Where Building.	Remarks.
Coast Defence Battleships.			
Aran	3,650	Gothenburg.	Under trial.
Wasa	3,650	Malmö.	Launched.
Manligheten	3,650	"	Building.
Tapperheten	3,650	Stockholm.	Launched.
Dristigheten	3,450	Gothenburg.	Under trial.
Armored Cruiser.			
Fylgia	4,600	Stockholm.	Building.

TURKEY.

A correspondent of the *Yacht* at Constantinople gives some interesting particulars concerning the Ottoman navy. There is a certain activity on the Golden Horn and in neighboring waters. Most of the Turkish ships are generally at Naghara on the Dardanelles, constituting what is known as the Squadron of the White Sea (Bahri Safid), that being the designation applied to the Archipelago and the Mediterranean. The Messoudieh is still at Genoa, but has been practically completed by Messrs. Ansaldo, while the Assar-i-Tewfik at Kiel is merely to have engine and boiler repairs, and some of the money which was to be expended upon

her may be devoted instead to a small cruiser to be built at the Germania yard. As is well known, a Turkish cruiser is in hand at Elswick and another at Philadelphia. It was lately decided that eight old ships shall be reconstructed, and Messrs. Ansaldo have already sent a body of workmen to Constantinople to undertake what is necessary on the spot. The work is going on, and Signor Perrone, manager of the Ansaldo yard, has been at Constantinople to make arrangements. It is expected that his firm will undertake the building of two destroyers. There is thus evidently a movement in Turkish naval affairs. Hassan Pasha, Minister of Marine, who has held his post for a quarter of a century, was nearly overthrown lately by a Palace crisis. In any case he cannot last long, for he is bending under the weight of age. One of his latest acts has been to change the system of distinctive flags.

UNITED STATES.

VESSELS BUILDING.

No.	Name.	Displacement. Tons.	Knots.	Where Building.	Degree of Completion. May 1.	June 1.
	Battleships.					
11	Missouri	12,500	18	Newport News Co.	91½	99½
12	Ohio	12,500	18	Union Iron Works.	73	75
13	Virginia	14,600	19	Newport News Co.	28	33
14	Nebraska	15,000	19	Moran Bros. Co.	19	20
15	Georgia	15,000	19	Bath Iron Works.	25	28
16	New Jersey	15,000	19	Fore River S. & E. Co.	34	37
17	Rhode Island	14,600	19	Fore River S. & E. Co.	34	37
18	Connecticut	16,000	18	Navy Yard, New York.	7	10
19	Louisiana	16,000	18	Newport News Co.	9	12
	Armored Cruisers.					
4	Pennsylvania	14,000	22	Cramp & Sons.	48	50
5	West Virginia	14,000	22	Newport News Co.	80	81
6	California	14,000	22	Union Iron Works.	26	28
7	Colorado	13,600	22	Cramp & Sons.	53	55
8	Maryland	13,600	22	Newport News Co.	47	49
9	South Dakota	13,600	22	Union Iron Works.	26	28
10	Tennessee	14,500	22	Cramp & Sons.	0	0
11	Washington	14,500	22	New York S. B. Co.	0	0
	Protected Cruisers.					
14	Denver	3,100	17	Neafie & Levy.	90	91
15	Des Moines	3,100	17	Fore River S. & E. Co.	85	86
16	Chattanooga	3,100	17	Lewis Nixon.	72	73
17	Galveston	3,100	17	Wm. R. Trigg Co.	66	66
18	Tacoma	3,100	17	Union Iron Works.	71	77
19	Cleveland	3,100	17	Bath Iron Works.	95	97
20	St. Louis	9,600	22	Neafie & Levy.	17	18
21	Milwaukee	9,600	22	Union Iron Works.	16	19
22	Charleston	9,600	22	Newport News Co.	35	39
	Torpedo Boat Destroyers.					
9	MacDonough	400	30	Fore River S. & E. Co.	99	99
	Torpedo Boats.					
19	Stringham	340	30	Harlan & Hollingsworth.	99	99
20	Goldsborough	245	30	Wolff & Zwicker.	99	99
27	Blakely	165	26	Geo. Lawley & Son.	99	99
29	Nicholson	174	26	Lewis Nixon.	98	98
30	O'Brien	174	26	Lewis Nixon.	98	98
34	Tingey	165	26	Columbian Iron Works.	96	96

VESSELS BUILDING.—CONTINUED.

No.	Name.	Displacement. Tons.	Knots.	Where Building.	Degree of Completion. May 1.	June 1.
	Submarine Torpedo Boats.					
1	Plunger	120	8	Lewis Nixon.	99%	100%
1	Porpoise	120	8	Lewis Nixon.	99	100
1	Shark	120	8	Lewis Nixon.	98	100
	Steel Tugs.					
1	Pentucket		12	Navy Yard, Boston.	70	80
1			12	Navy Yard, Mare Island.	13	20

On June 3 bids were opened for the construction of the three first-class battleships of 16,000 tons which were recently authorized by the naval appropriation act of 1903, to cost, exclusive of armor and armament, not exceeding $4,212,000 each.

In general characteristics these three vessels will closely resemble the sister ships Louisiana and Connecticut, now under construction, but in the matter of armor there will be an important departure which it is believed will give greater protection without adding to the weight carried. The general dimensions and features are as follows: Length of load water-line, 450 feet; breadth, extreme, at load water-line, 76 feet 10 inches; displacement on trial, not more than 16,000 tons; mean draught to bottom of keel at trial displacement, 24 feet 6 inches; gross draught, full load, about 26 feet 9 inches; total coal bunker capacity, about 2200 tons; coal carried on trial, 900 tons; feed water carried on trial, 66 tons.

The main battery will consist of four 12-inch breech-loading rifles, eight 8-inch breech-loading rifles, and twelve 7-inch breech-loading rifles, while the secondary battery will include twenty 3-inch 14-pounder rapid-fire guns, twelve 3-pounder semiautomatic guns, six 1-pounder semiautomatic guns, two 1-pounder semiautomatic guns, two 3-inch field pieces, two machine guns, caliber 0.30, and six automatic guns, caliber 0.30.

The 12-inch guns will be mounted in pairs in two elliptical turrets on the center line, one forward and one aft, and the 8-inch guns in pairs in four elliptical turrets, two on the beam at each end of the superstructure. The 7-inch guns will be mounted in broadside on pedestals on the gun deck behind 7-inch armor, each gun being isolated by splinter bulkheads of nickel steel from 1½ to 2 inches thick. The secondary battery will be distributed according to the usual arrangement, which was followed in the specifications for the Louisiana and Connecticut.

Armor Protection.—The total weight of armor to be used will approximate 4000 tons. The hull is protected at the water line by a complete belt of armor 9 feet 3 inches wide, having a maximum thickness of 9 inches for about 280 feet amidships. In the Louisiana and Connecticut this belt had a thickness of 11 inches, but extended only 200 feet, and it is believed that the new arrangement, while employing lighter armor, will give materially increased protection. Forward and aft of the main belt the thickness is gradually decreased to 4 inches at the stem and stern, but the extension of the maximum thickness according to the new design will completely cover the magazines.

Another important change is made in the lower casemate armor, which extends to the limits of the magazine spaces and reaches from the top of the water-line belt to the lower edge of the 7-inch gun ports on the main deck. In the Louisiana and Connecticut this armor was but 6 inches in thickness, but in the new ships it will be increased to 7 inches, while the athwartship bulkheads at the ends of this casemate will be but 6 inches thick.

The casemate armor around the 7-inch guns on the gun deck is 7 inches thick, and the splinter bulkheads are from 1½ to 2 inches thick. The protection of 3-inch guns is nickel steel 2 inches thick. The upper case-

mate athwartship armor extending from the shell plating to the 12-inch barbettes is to be 7 inches thick throughout.

The 12-inch barbettes extend from the protective deck to about 4 feet above the main deck and consist of 10 inches of armor in front and 7½ inches in the rear above the gun deck. Between the gun deck and protective deck there will be a uniform thickness of 6 inches. The barbettes will not have any special framing, the connection of the armor to the decks being sufficient. The 12-inch turrets will have a front plate 12 inches thick, rear plates 8 inches thick, and top plates 2½ inches thick. The 8-inch barbettes will be 6 inches thick in front and 4 inches thick in rear, with the upper tube 3¾ inches thick and the lower tube 3 inches thick. The 8-inch turret front plate will be 6½ inches thick, the rear plates 6 inches and the top plates 2 inches thick. The conning tower and shield will each be 9 inches thick; signal tower 6 inches thick. An armor tube 36 inches in diameter will extend from the base of the conning tower to the protective deck and will be 6 inches thick throughout.

Teak backing of a minimum thickness of 3 inches will be fitted behind all the side, athwartship, and 12-inch turret armor; 2 inches of backing to be fitted behind the 8-inch turret armor; other armor will be fitted without backing. All the above mentioned armor will be supplied by the government and will be fitted in place by the ship contractor, but all nickel-steel protection, with rivets, mutt straps and other connections, will be both furnished and fitted by the contractor.

Propelling Machinery.—The engines will be of the vertical, twin-screw, four-cylinder, triple-expansion type, of a combined indicated horsepower of 16,500. The steam pressure will be 250 pounds. The stroke will be 4 feet. The ratio of high pressure to low pressure cylinder will be at least 1 to 7, and the diameters will be sufficient for the required indicated horsepower at about 120 revolutions per minute. Each engine will be located in a separate water-tight compartment. They will be provided with all the necessary auxiliaries and accessories in accordance with the latest practice of the Bureau of Steam Engineering. There will be 12 Babcock & Wilcox boilers placed in six water-tight compartments. They will have at least 1100 square feet of grate and 46,750 square feet of heating surface, and must be able to furnish steam for the main engines, and all the necessary auxiliaries and accessories will be provided for the efficient working of the boilers. There will be three funnels, each 100 feet high above the base line.—*Iron Age.*

SPECIFICATIONS FOR THE GUNBOATS DUBUQUE AND PADUCAH.—The Navy Department has issued a circular defining the characteristics of the gunboats Dubuque and Paducah, bids for which are about to be called for. These vessels will be of the following dimensions: Length on load-water line, 174 feet; breadth, extreme, 35 feet; mean draft to bottom of keel at trial displacement, 12 feet 3 inches; mean draught, full load, about 13 feet 5½ inches; total coal bunker capacity, about 200 tons; coal carried on trial, about 100 tons; displacement on trial, 1080 tons. The vessels will be required to make 12 knots on trial. The hull will be composite to a point about 2 feet 3 inches above load-water line amidships, above which point it will be entirely steel. The armament will consist of six 4-inch rapid-fire guns, four 6-pounder rapid-fire guns, two 1-pounder rapid-fire guns and two Colt automatic guns. The engines will be vertical, twin-screw, triple-expansion type.—*Nautical Gazette.*

The United States torpedo-boats Dahlgren and Craven have been equipped with double rudders, one fore and the other aft, and they have been maneuvered in Narragansett bay during the last two weeks in command of Lieutenant-Commander Fletcher. It is reported that satisfactory results have been obtained. The experiments were ordered to determine

the use of double rudders, which will reduce the tactical diameter of torpedo-boats.—*Nautical Gazette.*

Secretary Moody has announced his acceptance of the three lowest bids for the three new 16,000-ton battleships, and the following awards have been made: Minnesota, to the Newport News Shipbuilding Company, of Newport News, Va., $4,110,000; Kansas, New York Shipbuilding Company, of Camden, N. J., for $4,179,000, and the Vermont to the Fore River Manufacturing Company, of Weymouth, Mass., for $4,165,000. Secretary Moody has ruled that portable equipment is not to be included in the limit of cost fixed by Congress, which was $4,212,000 for each ship.

Secretary Moody has approved the recommendation of the naval board on construction in regard to the design of the 13,000-ton battleships. The general characteristics are as follows: Length, 375 feet, breadth, 77 feet; mean draft, 24 feet 6 inches; trial displacement, 13,000 tons; horsepower, 10,000; trial speed, 16½ to 17 knots; battery, four 12-inch, B. L. R., eight 8-inch B. L. R., ten 7-inch B. L. R., twelve 3-inch B. L. R., six 3-pounder, four 1-pounder, two 3-inch field, two machine and six automatic.

Rear Admiral Francis T. Bowles, Chief Constructor of the Navy, has authorized this statement regarding the recent trials of the monitor Nevada off the Virginia coast: "The second trial of the 12-inch turret of the Nevada conducted by the board of inspection resulted in some damage to the rollers on which the turret revolves after firing two 12-inch guns simultaneously with full charges. Simultaneous firing of two guns by electricity is an unusual test. The turret operated satisfactorily after firing a number of single shots under various conditions of elevation. The board recommended fitting an additional number of rollers of different material, and adding some additional bolting, and the recommendation has been approved by the bureau of construction and repair. The flanges of some of the rollers were broken as a result of the unusual tests, and it probably will be necessary to remove the turret in order to make the repairs. This work will be done at the Norfolk Navy Yard whither the Nevada has been ordered."

NAVY GENERAL STAFF.—Those who are interested in the project of a general staff for the Navy have submitted a general proposition to the Secretary of the Navy and the President. An idea of the project may be gained from the following explanatory statement:

The general board is regarded as a start in the direction of a general staff to be under a chief possessing the directive and administrative charge of the chief of bureau of navigation. The plan calls for no changes in the existing organization of the department—it would be rather a rearrangement of detailed duties concerning the personnel, and pending the new legislation required in limited extent the department is considered as authorized to carry out the requisite measures for such a new partition of duties so that all matters of personnel, general efficiency and war readiness would be brought under one officer who would be directly responsible to the secretary and who would direct the military affairs of the fleet. That officer would be the ranking naval officer of the department. Under him would be first the bureau of navigation, bearing the more descriptive title bureau of personnel. Next there would be a division or section of the general staff specially charged with the formation and organization of all commissioned squadrons and vessels acting singly, and with their disposition and duties; with the consideration of all information concerning foreign fleets and naval matters; with the study of tactical questions and all matters of strategical significance.

There would be a general board, possibly called the general council, to pass upon and develop plans of campaign, naval policies under the principle now observed by the general board.

The officers intended for duty with the general staff would be selected on account of their peculiar fitness for the work for which they would be temporarily ordered, without danger of losing touch with the service and its needs. In time of war the general staff would become the staff of the admiral of the Navy, or of such officers as should be given command of the fleet, and the chief or general staff would become his chief of staff, ready to give all his acquired information to the admiral upon whose valor and discretion our safety will depend.

The proposed system for detailing officers for general staff duties after they have completed their tour of sea duty is expected to furnish a large number of officers who have made a special study of tactics, strategy and the detailed plans of campaigns, and who would thus become valuable as commanders-in-chief and their aids. A general staff would furnish a group of officers who, in time of peace, would plan for the naval defense of the coast, prepare general plans of campaign and for the proper distribution and efficiency of the fleet.

The following appear to be the duties of the general staff as at present contemplated: To devise plans that will employ our naval force to the best advantage; to organize, during peace, a proper naval defense of our coast, to utilize fully the naval reserves and merchant marine for the service of the general government; to secure, by frequent consultations with the Army chiefs, a full and cordial co-operation of the two services in case of war; to be prepared at all times to advise the Secretary of the Navy when required, as to the disposition of the fleet and all forces subject to his order, under the various conditions that may arise; to prepare plans of campaign for such theatres of war at home, in our dependencies abroad as may in any case become the scene of hostilities; these plans to include the selection of naval bases and their preparation; to have charge of the organization, training and discipline of the personnel; to advise and recommend as to the numbers and types of vessels needed in the future; to supervise the preparation and issue of such professional publications as may, in its opinion, be desirable for the information of the Navy Department, and for the education of the personnel of the Navy; and such other duties as the Secretary of the Navy may, from time to time, direct.

ORDNANCE AND GUNNERY.

Some interesting tests have recently been made at Indian Head to determine the effect of changes of temperature on the ballistics of the U. S. Navy smokeless powder. While not yet completed, these experiments indicate that the smaller grain powders are more affected by temperature than those for the larger grains. The powder charge of the 3-inch R. F. gun gave 2606 feet-seconds and 12.4-tons pressure when at a temperature of 25° F., while it gave nearly 2900 feet-seconds and 15.2-tons when at 98° F. The 6-inch R. F. charge gave 2264 feet-seconds and 11.0-tons at 17° F., and 2376 feet-seconds and 12.5-tons at 98° F.

The reasonable conclusion to be drawn is that dangerous increase of pressure is not to be feared as a result of the powder being at any temperature it is likely to reach on board ship.

The effective British war fleet may now be said to be provided, practically speaking, with cordite in place of gunpowder, and gradually the new propellant, known as cordite M. D., is being substituted for the earlier material. Although it is not so stated in the First Lord's memorandum, we believe we are correct in stating that it is at last decided to introduce "capped" projectiles for naval purposes. Experiments have been in progress for a long time, and in this connection the First Lord says: "The results have so far demonstrated the desirability of acting with caution as

to the general adoption of this invention, in view of its merit being dependent to a considerable degree upon the ballistics of the guns from which the projectile is fired, and the ranges at which it is more effective than others."—*Army and Navy Gazette.*

The Belleisle, which is now in dock at Portsmouth, is to be brought forward for torpedo attack in the harbor about June or July. The main purpose of the trial will be to ascertain the resistance of a compartment filled with coal.—*U. S. Gazette.*

THE NEW RIFLE FOR THE BRITISH ARMY.—The rearming of the British army with a new rifle is to be carried out at once, and all the plant at the various government arsenals is to be transformed with all possible dispatch to manufacture the new weapon. The transition is a sudden one, and all work upon the present type of rifle is stopped and the products abandoned. The new arm to be adopted is known officially as the "Lee Enfield Modified," and therein are incorporated many improvements and advantages. The weapon is five inches shorter than the Lee Enfield rifle at present in use, which will result in an appreciable reduction of weight. In fact, the weapon may most aptly be described as a compromise between a rifle and a carbine. Another feature is that the barrel is inclosed in a wooden casing throughout its entire length up to within an inch of the nozzle. In the present Lee Enfield rifle, there is a small wooden grip for the left hand, to afford protection from the heat of the barrel generated by rapid and continued firing, but the experiences of the Boer war proved that this protection is quite inadequate. The provision of this wooden casing on the barrel has necessitated an alteration in the device for fixing the bayonet. A nose cap is to be fitted, to which the bayonet is to be attached. There are several other modifications in the weapon, the most important of which is that at about ten inches from the nozzle of the rifle the bore is very slightly enlarged, and the enlargement continues right up to the nozzle. By this arrangement greater velocity of the projectile will be obtained, since at the point where the bore commences to increase, the force of the explosion of the cartridge has been expended, while if the bore continues to be the same diameter thereafter to the muzzle, the tight barrel means increased friction and reduction of velocity, whereas by enlarging the bore a very small fraction of an inch, the friction will be reduced and increased velocity obtained.

By diminishing the length of the barrel, however, the back and fore sights are brought closer together, which arrangement will entail greater care in taking aim, since the possible angle of error will be greatly increased. The back sight also is different from that at present in vogue, and is in fact the only part of the weapon which projects above the wooden casing. The flap is large, and is capable of adjustment up to a considerable range without being raised. The mechanism of the weapon is much simpler than the existing rifle, while the number of parts is less, which renders the arm less liable to derangement. The magazine, which will be completely concealed within the stock, will still carry ten cartridges, as is the case with the Lee Enfield; but instead of loading the magazine by hand as is now the practice, and which is very unsatisfactory and slow, a clip will be employed as in the Mauser rifle. Altogether, the new arm is claimed to be superior in every way to any other rifle at present in use.—*Scientific American.*

THE ARMOR OF BRITISH WARSHIPS.—Precise figures as to the total weight of armor of ships of different navies, are by no means always easy to procure, still they are procurable at times, and here are some placed in direct comparison with, so near as we can obtain them, the dates of the inceptions of the designs.

Date of design. circa.	Name.	Knots.	Nominal normal Displacement. Tons.	Normal coal. Tons.	Total Armor, with deck Tons.
1893–4.	Majestic	17·5	14,900	1,200	4,360
1894–5.	Kearsarge (U. S. A.)	16	11,500	410	3,419
1894–5.	Kaiser Friedrich (G.)	18	11,150	650	2,800
1895.	Canopus	18·25	12,950	1,000	abt 3,600
1895–6.	Alabama (U. S. A.)	16	11,525	800	3,432
1899.	Habsburg (Aust.)	19	8,340	—	2,250
1899.	Duncan	19	14,000	909	2,000*
1899.	Wittelsbach (German)	18	11,800	653	4,900
1899.	Maine (U. S. A.)	18	12,300	1,000	3,533
1897.	Cressy	21	12,000	800	2,100
1898.	Gambetta (French)	22	12,416	1,320	3,800
1894–5.	Diadem	20·25	11,000	1,000	1,900
1894.	D'Entrecasteaux (French)	20	8,014	650	614†

In each case the forign ship has an equal or superior armament. It may be noted also *en passant* that in almost all cases the speed of British ships is secured with relatively less horsepower than in foreign vessels. The coal supply at designed displacement we have given, also the weight of armor. It is perfectly useless for the official apologist to contend that British ships consume more armor. They do not. The Majestic, Alabama, and Maine all carry 28 per cent armor, the Kearsarge 29 per cent; Wittelsbach, 34 per cent Kaiser Friedrich, 34 per cent. As our ships are armed on the minor scale, they certainly ought to be armored on the major one, or *vice versa*.

The Cressy and Gambetta form the most striking contrast of any. The displacements are nearly identical. Yet the Gambetta carries more guns—four 7.6-inch and sixteen 6.4-inch, against two 9.2-inch and twelve 6-inch; more coal—1320 tons, against 800; thirty-three per cent armor—3800 tons, against 1200; and, finally, has a knot more speed. The Cressy carries 200 rounds for each 6-inch gun, the Gambetta carries at least 150, and, having more guns, certainly saves no weight here.—*The Engineer.*

TEST OF ARMOR FOR THE LIBERTAD.—The plate, which was made at Messrs. Vickers, Sons and Maxim's works at Sheffield, measured 8 feet by 6 feet, and has a thickness of 6¼ inches full. It is made by the Vickers-Krupp cemented process, and was tested at the Eskmeal Range, on the Cumberland coast, first on September 16 of last year, and again on January 16 of this year, the desire being to ascertain whether lapse of time had developed any further effect upon the first attack.

The first shot fired at the plate was at the right top corner, and was from a 6-inch gun with a charge of 14.25 lbs. of cordite, the striking velocity being 2110 foot-seconds and the energy 3087 foot-tons. The only effect on the plate was a flaking, and a penetration which did not exceed at any point 1⅞ inches.

The second shot, also of the so-called "armor-piercing" type, was at slightly increased energy, but here again the shot was completely broken up, and the parts are shown in front of the plate in our engraving.

For the third round it was decided to use the 6-inch shot fitted with the Johnson cap, as manufactured at the Barrow Works of the Vickers Company, the weight of the cap being about 7 lbs. The striking velocity

*Official figure. Must refer to side armor only; total cannot be much less than 3,000-4,000. †Probably omits deck.

RESULTS OF TRIALS OF 6"-12". VICKERS-KRUPP ARMOR-PLATE FOR CHILIAN BATTLESHIP LIBERTAD.
First, Second and Third Round Fired on September 16, 1899; Fourth, Fifth and Sixth Fired on January 16, 1900.

RESULTS OF TRIALS OF 6⅞-IN. VICKERS-KRUPP ARMOR-PLATE FOR CHILIAN BATTLESHIP LIBERTAD.

First, Second and Third Round Fired on September 16, 1902; Fourth, Fifth and Sixth Fired on January 16, 1903.

Round.	Weight and Nature of Charge.	Weight and Nature of Projectile.	Striking Velocity.	Striking Energy.	Penetration.	REMARKS.
			ft.-sec.	ft.-tons.	in.	
1	14·25 lb. cordite $\frac{20}{17}$	6-in. A. P. shot, Elswick, 100 lb.	2110	3087	1⅛	Shot broke up completely. No cracks. Flaking measured 22 in. H by 19 in. V.
2	Ditto	6-in .A. P. shot, Elswick, 100.75 lb.	2124	3149	1⅛	Shot broke up completely. No cracks. Flaking measured 29 in. H by 20 in. V. (See Fig. 1.)
3	14·2875 lb. cordite $\frac{20}{17}$	6-in. A. P. shot, Vickers, fitted with Johnson cap; 107 lb.	2116	3323	Through.	This capped shot was fired with a charge giving an equal velocity to Round 2. There was complete perforation of plate, backing, and skinplate. Projectile was broken up in several large pieces, most of which were found in front of plate. A piece of plate was punched through the backing and skinplate, and picked up 38 ft. in rear. Diameter of hole was 6¼ in. No cracks. Flaking measured 21 in. H by 13 in. V. (See Fig. 2.)
4	14·2187 lb. cordite $\frac{20}{17}$	6-in. A. P. shot, Elswick, 100.125 lb.	2104	3073	1⅛	Shot broke up completely. No cracks.
5	Ditto	6-in. A. P. shot, Elswick, 100.1875 lb.	2104	3073	1⅛	Shot broke up completely. No cracks. (See Fig. 3.)
6	33.25 lb. cordite $\frac{20}{30}$	7.5-in. A. P. shell, fitted with Johnson cap, 204.6875 lb.	2107	6301	Through.	Shell broke up. Point and base plug found 20 ft. in rear. All pieces passed through plate. No cracks. (See Fig. 4.)

NOTE.—The temperature of the charge was 80 deg. Fahr. in all cases. On September 16, 1902, the thermometric readings were 57 deg. Fahr. by dry bulb and 51 deg. by wet bulb, the barometer showing a pressure of 29·6-in. On January 16, 1903, the dry bulb recorded 32 deg. Fahr., and the wet bulb 30 deg. Fahr., while the barometric pressure was 30·17in.

was about the same as in the two previous shots, with slightly increased energy, due, no doubt, to weight. This shot was directed to the center of the plate, and the projectile went through the plate and the backing behind. There can be no doubt as to the enormous power of propulsion maintained by the shot after impact; the diameter of the hole made in the plate was only ½ in. more than the shot itself, and there was absolutely no crack in the plate. The extent of flaking from this shot is rather smaller than in the case of the second shot. A piece of the plate, moreover, was driven through the backing and the skin-plate beyond the backing of the armor-plate, and was picked up 38 feet in the rear. The shot was completely broken up.

As we have already said, it was decided to delay the firing of the next three shots for four months. The fourth shot, which was the first fired on January 16, was aimed near the top left-hand corner. It should, perhaps, be explained here that the three original shots had, through lapse of time got slightly rusted over. The fourth shot was again from the 6-inch gun, and was of the so-called "armor-piercing" type. Here the velocity was 2104 feet per second, and the striking energy over 3000 foot-tons. The plate still stood well up against the attack, the extent of penetration being only 1¾ inch, but there was, as shown in the engraving, very considerable flaking, due probably to the close proximity immediately below of the second round.

The fifth shot, from the same gun and at the same energy, was fired at the right center, and here again the shot was completely broken up.

After this severe trial, it was decided to attack the plate with the 7.5-inch gun, firing an armor-piercing shell fitted with a Johnson cap as made by the Vickers Company. Such an attack upon a plate of 7-inch, following on five shots, was a severe punishment. The plate shows not a single crack, which is proof of the satisfactory manufacture; but at the same time it was made obvious that Krupp armor, even of the very best quality, cannot withstand an attack from a capped shell. The 7.5-inch gun, with a charge of 33.2 lbs. of cordite, developed a velocity of 2107 feet per second, which is not so high as is possible with this weapon using a greater charge, or nitro-cellulose powder. The energy developed was 6301 foot-tons. Even at this comparatively low energy, the capped shot went through the amor-plate, the backing, and the skin-plate beyond. Daylight, as shown in the photograph, appeared through the hole in this case, as well as in that of the hole immediately below it, which had been made by the capped shot from the 6-inch gun; again the diameter of the hole was only a little more than that of the shell. Although the shell in this case was broken into pieces, the fragments passed through the plate, the point and base-plug being found 20 feet to the rear, and the base-plug was not deformed to any extent.

It is therefore evident that even with this striking energy of 6300 foot-tons it would be possible for an explosive shell to find its way through 7-inch armor into the interior of the ship, and there do very serious damage. The 7.5-inch gun has on other official tests developed a muzzle velocity of 2920 feet per second, and an energy of 11,800 foot-tons—almost double that on the occasion of the attack against this 7-inch armor—so that, with superior propelling powder, it is possible to conceive that the degree of penetration on this occasion could be attained at very considerable ranges. In any case the trial establishes the efficiency of the Johnson cap against the very best armor.—*Engineering.*

THE WORLD'S RECORD FOR NAVAL GUNNERY is now held by Second-class Petty Officer and Seaman Gunner W. Rowe, of his Majesty's ship Ariadne, flagship on the North American station. Letters received at Plymouth state that at target practice recently Rowe was captain of a 6-inch quick-firing gun. Ten rounds were fired in a minute, and ten hits were recorded.—*Engineer.*

H. M. S. Formidable has recently fired twenty-seven rounds, each round costing the country about £62. These twenty-seven shots were fired at a target 600 square feet in area at a range of about 1500 yards. This range is one at which probably no battleship would engage in time of war on account of torpedoes. Of the twenty-seven rounds fired by H. M. S. Formidable one hit the mark, giving a percentage of 3.7. H. M. S. Formidable cost considerably over £1,000,000. The guns of the Formidable, made at Woolwich, are admirable weapons. What is the war value of a £1,000,000 battleship that misses a small target at a short range twenty-six times out of twenty-seven.—*Spectator, London.*

We learn from a note in the *Moniteur de la Flotte* that the French are proposing a very practical gunnery trial. Some little uncertainty attends the matter, but it would appear that preparations are being made, and that in June or July a turret of the Suffren will be subjected to the fire of 9.4-inch gun, the projectile being filled with sand. The idea is to ascertain what would be the effect of the impact of such a shock upon the turret of a modern battleship. The range is likely to be rather short, so that there may be no doubt of the projectile hitting the turret, and a gunner from Gâvres will be in charge of the operations. M. Bertin and other high engineering and ordnance experts will be present. The turret will be covered with additional plating so that there may be no risk of the shot penetrating, the sole object being to test the effect of the shock resulting from the impact.

STEAM TURBINES.

Rapid Development of the Steam Turbine.—In the development of what might be called the epoch-marking inventions of the day, it is noticeable that there has been in almost every case a point at which the invention, having clearly demonstrated its commercial value, entered suddenly upon a period of rapid and widespread development. Evidently we have reached such a point in the history of the steam turbine. The story of the determination of the principles of operation of the steam turbine, and of the embodiment of those principles in a practical and commercially-useful machine, will be forever identified with the names of De Laval and Parsons, the first named having proved the usefulness of the steam turbine for work that required a small, high-speed motor of moderate power, while Parsons met and satisfied the demand for a prime mover of lower speed and great power. Of late years other inventors have produced more or less successful machines of the turbine type, and chief among these are the Rateau turbine in Europe and the Curtis machine in this country.

Because of the wide variety of uses to which it may be put, and the unprecedented power of some of the larger machines that have been built and put into very successful operation, the Parsons turbine is the best-known machine to-day, both in this country and in Europe. It was already well established and had made its great reputation abroad, when the rights for the United States were secured by the Westinghouse Company, and with the powerful influence and prestige of this concern behind it, the Parsons turbine is having a remarkable growth both in this country and abroad. A case in point is the contract recently given to the British Westinghouse Company by the Metropolitan District Company of London, for four huge turbo-alternators. Each of these machines is designated for a normal capacity of 5500 kilowatts, but will be capable of carrying an overload of 50 per cent, thereby giving for each unit a maximum output of 8250 kilowatts, or say about 11,000 horsepower. As proving how early

in its career the steam turbine has shown its ability to compete in size of individual units with the largest reciprocating engines, we may mention that these engines will be not only the largest turbines ever made, but also the most powerful single-cylinder engines of any type whatever in the world. Indeed, very few multiple-cylinder engines in existence have greater maximum power. As showing the wonderful compactness of this type of engine, it may be noted that in spite of their enormous power, the Metropolitan turbines are only 29 feet in length by 14 feet in width and 12 feet in height, while the length over all of the turbine and alternator complete is only 51 feet, 9 inches.

If there is a drawback that can be urged against the steam turbine, speaking of it broadly, it is the extremely high speed which is necessary, if the best results in economy are to be secured. In the De Laval type the speed is so great that for almost every class of work to which it is put, some form of reducing gear is necessary; and the construction of a satisfactory gear for such work is rendered practical only by the comparatively small units in which the De Laval type is built. In the Parsons turbine, a more moderate speed of revolution is possible, but even here the speed is higher than is for many classes of work desirable; indeed, for marine propulsion the high speed of revolution has placed very arbitrary limits upon the type, size and number of propellers that may be used. For this reason among others, great expectations are being placed upon the turbine that has been developed in this country, and is called by the name of its inventor, Mr. Curtis. This machine embodies some of the features both of the De Laval and the Parsons type. Like the former, the steam is fed to the moving blades by a series of steam nozzles, and like the Parsons type, the series of moving blades are arranged alternately with series of stationary blades, while it also embodies the compound and condensing features which have conduced so greatly to the success of the Parsons machine. An element that is greatly in its favor is the fact that the axis of the machine is arranged vertically, the turbine and its alternator in turbo-electric plants, being arranged one above the other on a common vertical shaft. This results in considerable economy of engine foundation and floor space, and will prove to be a distinct feature in favor of this type in city power plants and in installations where floor space is limited and costly. Like the Parsons, the Curtis turbine has been taken in hand by a large electric manufacturing company in this country, the introduction and development of it being carried on by the General Electric Company at Schenectady. Already several large orders for this type are being executed.

The indications are that the steam turbine in its various forms will, before long, be in practically exclusive occupation of the electric lighting and electric power plant field. Regarding the range of its application in the merchant marine, it is less easy to prophesy. It seems to have proved its value as a motor for the propulsion of yachts, torpedo-boats, and the smaller class of passenger steamships. Whether it will give equally good results in the slow freight steamer and the large, high-powered, fast-steaming Atlantic liner, and in big battleships and cruisers, has yet to be proved. The immediate obstacle to overcome is that of reversing, which at present can only be done under limited power; but outside of this difficulty, we are aware of no fact developed in the course of the extensive trials of the steam turbine in the propulsion of ships which indicates that it will not give as good, and probably better results, in the larger as it has in the smaller class of vessels.—*Scientific American.*

The Turbinia Company, the German Parson Marine Company, of Berlin, has received two large orders for marine turbine installations from F. Schichau, of Elbing, and the Vulcan Company, of Stettin, to be used for the Imperial Navy of Germany. One installation of 5000 H. P. is for a sea-

going torpedo-boat, the other is for 10,000 H. P. for a small cruiser, the Merkur. These will be the first ships of the German navy in which reciprocating engines have been supplanted by steam turbines. For both installations steam will be supplied by water-tube boilers at 15 atmospheric pressures. Two of the five turbines for the torpedo-boat are cruising turbines, i. e., intended for low speeds. The turbines are arranged on three shafts, each of which operate two propellers, and make about 700 to 800 revolutions per minute. There are two copper condensers of the usual naval type. The steam is not superheated. The speed of this torpedo-boat is to be about 27 knots.

For the cruiser Merkur six turbines are contemplated, operating four shafts, each of which carry two propellers. Two of these turbines are for cruising speeds: revolutions, 650 per minute; speed, 22 knots. A notable feature is that the entire plant will be below the protective deck. The screws will be well below the water line, thereby insuring protection from gun fire in battle as well as smooth running during heavy seas.

The new turbine steamer, launched at Dumbarton on Saturday for the South-Eastern and Chatham Railway, is 310 feet long, with a moulded breadth of 40 feet and a depth of 25 feet, and has a complete awning deck. On this deck there are a number of special cabins provided for the convenience of passengers. Above this first-class accommodation there is a long promenade deck, extending out to the ship's side, which shelters the awning deck in wet or rough weather. The machinery will consist of Parsons' turbines, three being fitted, with three lines of shafting. In maneuvring, the center shaft runs free, and the two side shafts then take the place of ordinary twin screws. The average sea speed is to be 21 knots.—*Engineer.*

Some particulars of the Curtis steam turbine are given in a paper read before the American Philosophical Society, by Mr. W. L. R. Emmet. This steam turbine is a compound turbine of the type which seems, so far as our information goes, to have originated with Mr. Ferranti, whose English patent is numbered 2565 of 1895. Whilst, however, Mr. Ferranti seems to have done little or nothing to embody his ideas in practical form, the same ideas have been taken up and experimented with by the General Electric Company of America, who, after some years' experimenting, are now prepared to make these motors on a commercial basis. The difference between the Ferranti type of compound steam turbine in question and the ordinary Parsons type lies in the fact that, as in the De Laval turbine, the whole energy of the steam is utilized in giving velocity to the steam before it issues from its first set of guide-blades or nozzles. In the De Laval turbine there is one set of nozzles or guide-blades only, and consequently the wheel has to have a very high peripheral speed; but in the Ferranti type, the steam, after impinging on a first set of buckets, leaves these with a velocity which is still high, and is then diverted through a series of guide-blades on to another wheel, where more of its velocity is abstracted. By using a sufficiently long series of guide-blades and wheels, it is possible to arrange for the latter to run at a relatively slow speed. Thus in the case of a 600-kilowatt Curtis turbine, built by the General Electric Company, it appears from Mr. Emmet's paper that the speed is 1500 revolutions per minute, the corresponding bucket speed being 420 feet per second. Curves of results included in Mr. Emmet's paper indicate a stream consumption of 19.1 lbs. per kilowatt-hour at full load, using dry saturated steam at an initial pressure of 140 lbs. per square inch. With steam at the same pressure, but superheated 150 deg. Fahr., the same consumption appears to be 16.2 lbs. per kilowatt-hour, the vacuum being 28½ inches of mercury. We note that a 5000-kilowatt unit now being built for Chicago will soon be ready for testing.

WIRELESS TELEGRAPHY.

The Admiralty, so we understand, have come to an understanding with the directors of Marconi's Wireless Telegraph Company. Already, under a tentative agreement, thirty-two ships of his Majesty's are fitted with Marconi apparatus. Under the new agreement—which only awaits formal ratification—the government will pay the company a lump sum, and thus take omnibus powers to use wireless telegraphy on every ship in the navy. —*Engineer.*

A system of wireless telegraphy due in its main outlines to Sir Oliver Lodge, but which has been worked out on a commercial basis by Dr. Muirhead, has been fitted to the cable steamers Restorer and Patrol, just completed for the Eastern Extension system. It is intended in this way to keep the steamers in communication with the different cable stations. The special feature of the apparatus is the new form of coherer used, which decoheres automatically without being tapped. It consists of a disc of steel dipping into mercury, on the surface of which is a film of oil. When in use the disc is kept in continuous rotation.—*Engineer,* March 6.

The signal stations which have been fitted with wireless telegraphy are Dover, Culver Cliff, Portland, Rame Head, the Scillies, and Roche's Point. During this year the apparatus is to be fitted at Bere Island, Spurn Head, Alderney, St. Abb's Head, Land Guard, Portpatrick, and Duncansby Head. Commercial signalling under the new arrangements with Lloyd's is to be carried out at Culver Cliff, the Scillies, Spurn Head, St. Abb's Head, St. Ann's Head, Duncansby Head, and Roche's Point.—*Army and Navy Gazette.*

Dr. Fleming devoted a large portion of his concluding lecture on "Hertzian Wave Telegraphy" to the discussion of the means necessary to ensure privacy, and the effectiveness of the present methods. He explained at some length the meaning and use of syntonization, and showed by experiments that it was possible to so tune a transmitter and a receiver to each other that the latter would reject all messages not intended for it, and he went on to ask how far this solution was satisfactory in actual practice. It had been stated, he said, that large power stations would play havoc with the messages transmitted from stations of smaller power, and, in order thoroughly to satisfy himself on this point, he had made arrangements with Mr. Marconi that certain plant and apparatus should be put wholly and solely at his disposal for a series of experiments, which were made on the 18th of this month. These tests were made in Cornwall, the great aerial which is used for the transmission of Atlantic messages and the simple and small apparatus which communicates with ships passing up the Channel being employed. The object of the trials was to find out if powerful messages given out by the great Poldhu aerial would interfere with the much weaker messages from the ship apparatus, or whether the syntonization was so effective that, although both aerials should be speaking at the same time, only the right messages would be received by the instruments intended for their reception. Great care was taken to prevent any collusion between the operators and to put the experiments above any hint or suggestion of juggling. In all, sixteen messages were sent, eight from each station. They were, in the one case, messages of the kind that might be transmitted across the Atlantic; in the other, messages such as would pass between a ship and the shore. Up to the moment of transmission they were kept in sealed envelopes and known only to Dr. Fleming himself. These messages were sent out from the two aerials at Poldhu, both apparatuses working for ten minutes together and then resting for five altogether two hours being consumed in the transmission of the eight

telegrams. At the Lizard, six miles away, two receivers were set up, one to take the "Atlantic" and the other the "ship" messages. Of the latter not a single one presented any difficulty and of the others seven were absolutely perfect, and one, whilst being a little confused in the first few words, was read with but little trouble by Mr. Marconi. Some of these telegrams, it should be mentioned, were in cypher. He thought these experiments justified him in stating absolutely that messages from the big aerial did not interfere in any way with the much less powerful ones from the ship station.

There was, however, another question, and that was, whether powerful oscillations sent out from a big station would interfere with other people's messages, that was with receiving instruments not especially designed to accept them. This, he explained, depended upon whether the other people's circuits were responsive or not. If they were very responsive they would probably be interfered with, just as a light pendulum might be put into violent vibration by a single fillip, whilst only regular, properly timed blows could set a heavy weight swinging. It did not do, therefore, to have too responsive a circuit. It would pick up too many things. He did not deny that if a person had sufficient skill and patience, and the proper apparatus, any message might be tapped, but such a person would be one in a million, and he did not think much to be feared from his endeavors.—*Engineer.*

In quite another direction the preparation for war goes on. We have already announced that six of the coast signal stations have been fitted with wireless telegraphic apparatus, and eight others are to be similarly fitted during the year. It is also proposed to establish nine more later on. To provide crews for the new signal stations which are to be kept manned in peace time and for the wireless telegraphy work, the *personnel* of the Coastguard it is proposed shall be raised from 4200 to 4500. But during this year only a small addition will be made. The reorganization of the Reserves, which will largely increase the duties of the admiral-superintendent functions. And he will no longer command a seagoing fleet. It seems likely also that he will have assistants for Ireland and Scotland.—*Army and Navy Gazette.*

THE COOPER HEWITT INTERRUPTER AS AN AID IN WIRELESS TELEGRAPHY.—Each advance in wireless telegraphy has emphasized the inefficiency of the spark-gap interrupter, and this element has threatened to be the weak factor in the commercial development of aerial transmission. In the Marconi trans-Atlantic experiments the power required at the disruptive gap was enormous in comparison with the presumable quantity of energy radiated from the antennæ, and a serious incident of the great local disturbance thereby set up has been the adverse effect on telephonic service over a wide range, which forecast trouble for the exploiters of commercial wireless telegraphy. It is, therefore, a matter of unusual interest to learn that an interrupter for an oscillating circuit has recently been devised which not only very greatly reduces the draft on the source of electrical energy but possesses most valuable properties with respect to exact control, and at the same time is extremely simple in form and application.

In wireless telegraphy the spark-gap oscillating circuit has heretofore been employed, either in connection with the simple induction coil or the disruptive gap. In his studies on the mercury vapor tube, it occurred to Mr. Peter Cooper Hewitt that the "electric valve" property of the vapor tube, which he has employed in his static converter, could be applied to the oscillating circuit. This application he has succeeded in carrying out in a most successful manner.

Briefly stated, the spark-gap of the oscillating circuit is replaced by a mercury vapor tube in parallel with a condenser. Assuming that the im-

plication, and the nature of the work to be performed. The transformer secondary in series are a condenser and the primary of the antennæ-ground circuit, the condenser being shunted by a vapor tube. The tube does not differ in principle from the usual Cooper Hewitt vapor tube, though naturally of a somewhat different form, owing to its different application, and the nature of the work to be performed. The transformer secondary voltage may range between 10,000 and 20,000 volts.

The fundamental advantage of this interrupter is the enormous speed of interruption that may be attained, and the absolute control of this speed. Moreover, by proper design and adjustment, any given rate of adjustment can be secured. With the disruptive spark there is a limit to the efficient rate of interruption fixed by the time required for the condenser to clear itself, and this rate, as well as the total effect, is variable, owing to the mobility of the arc, the condition of the knobs with respect to polish, etc. This latter consideration does not apply to the mercury electrode surface, and the vacuum discharge is not subject to similar fluctuations. It follows that with this new type of interrupter it is possible to create and maintain continuously oscillations of an absolutely definite character, the great importance of which consideration with respect to wireless telegraphy is obvious.

The practical advantages of the interrupter are no less evident. The efficiency is very high, the loss being about proportional to the drop of about 14 volts in the tube, and in a circuit of 10,000 volts this amount to but a small fraction of 1 per cent. The device, consisting merely of a glass tube or bulb with sealed-in electrodes, is inexpensive, and in case of breakage can be immediately replaced by another in the same manner as an incandescent lamp.—*Electrical World.*

Some Problems in Space Telegraphy.—Among the small army of workers in the field of labor made so brilliantly attractive by Mr. Marconi, an amount of research is now going on that is probably only approached in magnitude by the contest for recognition and supremacy among telephone inventors at the time Bell's magneto telephone received such a memorable "boost" into commercial importance by the kindered invention of the carbon transmitter. With the advantage of the more complete knowledge of electricity and the increased mass of theoretical and applied precedents that obtain to-day, both the followers of Hertz in the realms of pure science and a large company of practicians of the type of Mr. Marconi are busily engaged in a competition to produce results in this fascinating field of endeavor. The student and observer of the widening domain of electricity, and the electrical engineer desirous of keeping informed on the whole progress of an art in which he practices a specialty, are put to it nowadays to follow even the main thread of the department, so full of incalculable promise, of signaling through space with no artificially installed communicating line, and by methods of propagation of dielectric stress exerted at right angles to a conductor, that were but yesterday generally unknown.

At the present time many competitive schemes are, in a measure, being disclosed through the issue of patents which, while not complete any more than space telegraphy itself is perfected, yet are indicative of the trend of the work of the several inventors. The names of the proprietors of the various principal systems of wireless telegraphy or telephony are in the minds of all readers of the electrical press, but the claims made for each system, at the implied expense of all the others, produce an effect of confusion and uncertainty in the mind of the reader, and also of the close student of the whole subject, who is desirous of estimating the value of the progress claimed here and there, and so of forming a just idea of the general net advances toward the commercial perfection of the whole art of "wireless." It is for the purpose of clarifying the subject a little, by

making a brief presentation of some of the detailed problems yet unsolved, or only partially solved, that the writer submits the following remarks.

The most prominent at present—and, perhaps, in the last analysis, the most important—of these matters is the matter of tuning. Since in wireless signaling there is no line, but the action at a distance, on which the method of signaling depends, makes use of the medium, in space, common to two pairs of signaling stations, dispositions at the terminal apparatus alone must be depended upon to make such particularized and non-interfering use of the ether, as well as of the earth return, that a virtual "line" will be as truly and commercially realized as though established with poles and a length of wire. The medium that inundates all space must be selectively disturbed by manipulation of the electrical constants of the terminal apparatus. Electrostatic capacity and inductance, associated with ohmic resistance, are physical entities whose relations, in combination mean the possibility of designing circuits that will favor the continuance of alternating electric currents of stated frequencies. Ever since this was recognized by experimenters attracted to the wireless field, they have taken up the idea of working with secret, non-interferable, selective or tuned oscillations that will penetrate to a greater distance than the originally used free oscillations of Marconi's first tests, and this has been a favorite claim and field of endeavor toward result. This special application of the study of harmonically alternating currents is a fascinating one. For, compare the elementary presentation of the means of transmitting and receiving free oscillations in Fig. 1, corresponding to the early Marconi station, and the means of transmitting and receiving oscillations more rigidly controlled in frequency, as indicated in Fig. 2, representing a possible arrangement of inductances and capacities applied to the antennæ at a pair of stations. In the former case the transmitting antenna itself, through the distributed inductance and capacity that it possesses inherent to its length and distance from the ground, determines which particular frequency is most favored in the group of various oscillatory currents that surge in it when the potential difference at its foot breaks down the spark-gap to ground. But the other frequencies present are not entirely inhibited by the electrical constants of the antenna, A; and hence, while a receiving circuit with simple coherer connections, as in Fig, 1, will be operated more positively or at a greater distance if its antenna, B, is of the same length and has the same constants as A, yet this state of affairs does not constitute tuning, for the reason that receiving antennæ of the lengths will have set up in them oscillating electromotive forces sufficient to break down the coherer of these stations, provided the group of series of free oscillations in A, or any one of the group, is sufficiently powerful to set up electromotive forces in B as an aperiodic conductor. In the latter case, Fig. 2, the transmitting and receiving antennæ are themselves parts of circuits in which an attempt is made to effect electrical tuning. On the one hand it is endeavored to limit the frequency of oscillation in the transmitting antenna, T, to the particular frequency most favored—"selected"—out of the composite discharge at the spark-gap by the electrical constants of that part of the tuning circuit drawn in heavy lines. To generate this frequency, and to give rise to a series of waves therefrom makes use of nearly all the energy of the transmitting circuit. On the other hand, also, a more sensitive receiving circuit is sought (shown also in heavy lines) by providing this with such electrical constants that the particular frequency set up by A, shall give rise at the receiving station to an oscillating electromotive force in a path, of which B is a part favorable to the continuance of a current of the said frequency and to the development of a persistent train of comparatively high successive electromotive forces that shall break down the coherer. To touch briefly on the mutual operation of the circuits shown, it may be said that the connections at the foot of A^1 comprise a source of potential difference delivered at

the points *a b*, which breaks down the spark-gap connected across these terminals of the inductance, *c*, and of the derived circuit, comprising the inductance, *d*, and the distributed inductance and capacity to ground of A^1. If, now, the capacity in the antenna branch of this circuit is properly proportioned to the inductance branch C, with due regard to the inductances in *d* and in the vertical wire itself, the flow of oscillatory current in A^1 and *d* will be nearly opposite in phase to that in *c*, and may be very largely compared to the current oscillating at the spark-gap. Under these conditions, assuming proper construction of inductances and avoidance of resistance losses in the circuit and the spar-gap a powerful train of waves would emanate from A^1. In the antenna B^1, exposed by

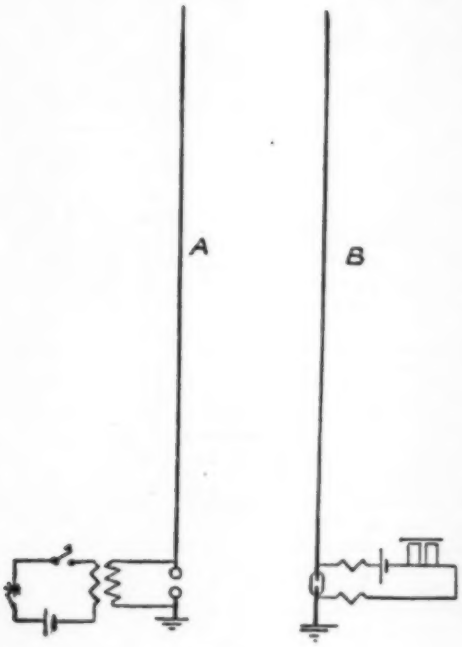


Fig. 1.

reason of its great distance from A^1, to only a minute segment of the wave front emanating from A^1, minute but persistently oscillating electromotive forces will be set up, and their persistence will be favored by the inductances of *f* and *g*; *f* being in series with the inductance and capacity to ground of B^1. Electromotive forces of the two halves of this series circuit be in nearly opposite phase, and electromotive forces in *g* will be indefinitely large compared to those impressed upon the circuit, B^1 *f g*, by an impringing wave from A^1; so that a coherer in a suitable circuit connected to the terminals of *g*, would be broken down as a result of electromotive forces, operating in the vertical wire circuit, too feeble to do so directly.

It must be borne in mind that the circuits shown are simply illustrative of the possible species of arrangement in syntonized wireless signaling.

After the mass of special work necessary to develop the proper construction of condensers and inductances for the generation of high frequency oscillations, and for the separate and no less special conditions at the receiving end for the transforming of the impinging waves into oscillatory electromotive forces, the ground work only of the full achievement of effective tuning has been laid. Failures to get the practical results expected after the most careful design of apparatus are found to be due to the fact that the use of the spark-gap brings in at the transmitting end the trouble of too short a train of waves by reason of the damping effect

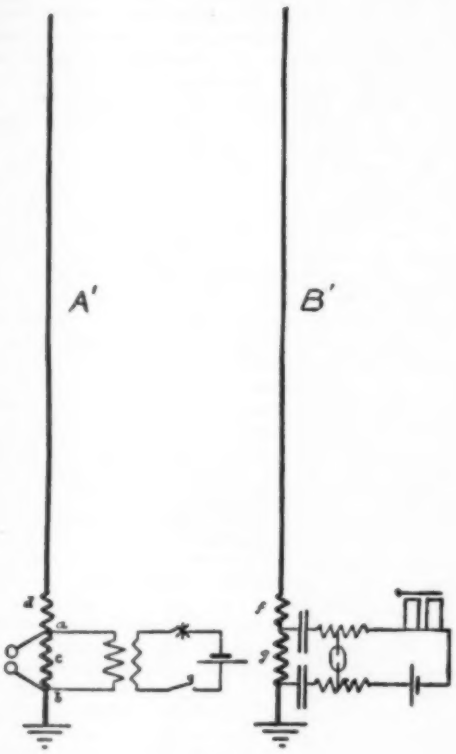


Fig. 2.

of the resistance of the spark-gap, if the balls are separated beyond a small fraction of an inch for the sake of reaching a receiving station placed at a greater distance by giving the higher impressed electromotive forces due to the longer spark. There is soon reason to believe that this difficulty will be overcome by improvements in the spark-gap, perhaps along the line of the new Cooper Hewitt interrupter, whereby not a rapidly decaying train of oscillations is produced, as in the present spark-gap of polished knobs separated by air, but a consecutive series of half-oscillations of maximum amplitude may be impressed upon the antenna. Assuming this to have been done, there remains the disturbing effect of the coherer or

other wave conductor upon an accurate tuning of the receiving station, by reason of its high resistance when in a state ready to receive the signal. The auxiliary tuned circuits of Stone, inserted inductively as intermediaries between antenna and coherers, whereby the high resistance of the coherer is made to have no disturbing effect upon the tuning, and the use of the anticoherer of DeForest, and of the bolometer of Fessenden, are attempted remedies of this difficulty or evasions of it, whereby the theoretic accuracy of tuning of the receiving circuit may be realized. The failures that have been made to realize effectively tuned circuits, resonant through etheric waves when an ordinary air spark-gap is employed as the exciter of oscillations in a tuned or non-tuned transmitting circuit, may be roughly compared to attempts to excite a tuning fork to sympathetic vibration by setting into vibration a consonant fork, immersed in molasses, by sharp, infrequent blows of a hammer. The requisites of a successful apparatus to replace the spark-gap may be indicated by the approximate analogy of the practically operated method of exciting a secondary tuning fork by bowing or otherwise continuously sounding the primary consonant fork upon a sounding board in air.

Recent important patent issues have been silent on the subject of attempts to direct signaling waves. A successful accomplishment of this would mean the attainment of a kind of selectivity without tuning, and great economy of the power required by the sending antenna. In regard to the latter point, the need is already apparent in difficulties which are reported in making and breaking quickly circuits of high voltage and considerable power used in Mr. Marconi's long-distance signaling. Fessenden's wave chute is a device whose reported assistance to the efficiency of signaling apparently consists in providing an extraordinary large virtual area of contact with ground, the major axis of this enlarged area of contact being placed favorably to the propagation of waves in the actual direction of the receiving station. The considerations of merit in this scheme constitute a problem in the theory of potential losses in an electrical circuit, roughly analogous to the ground return losses in an electric railway system insufficiently equipped with return feeders. More directly comparable is the phenomenon that the loss by absorption of a light is apparently reduced by enlarging the luminous surface for the same candlepower. The luminiferous ether close to a powerful electric arc acts with apparently lower efficiency in propagating the light waves than the ether surrounding a combustion flame of the same total candlepowder, but of much greater luminous area.

Speed of working, the point last to be mentioned but not least in importance, may be dismissed for the limits of this article with the statement that it is almost wholly a matter of the obtaining of persistent trains of waves, whereby the number of such trains for a positive intelligible signal may be diminished; and of dead-beat quality of receiving apparatus, whereby the signals, though shortened in length, and with correspondingly short intervals between them, will be preserved in distinctness. The self-decohering detector just heralded by the Lodge-Muirhead system—a steel surface continuously moving in apparent but not actual contact with mercury till electrical contact is established by the receiver wave—seems a long step in the direction of improved speed of working. With the coherer and its present experimental successors reduced in practice to a device corresponding in improvement to the modern siphon recorder used on ocean cables, as compared with the light-spot Thomson galvanometer that preceded it, space telegraphy will be far advanced toward a position of active competition with the present cable.—*Scientific American.*

MISCELLANEOUS.

LORD CHARLES BERESFORD has followed words with deeds in the Channel Fleet. Amongst other things he makes each captain maneuver the fleet in turn. The idea is not novel but it is all too rare. As a result, when the present Channel Fleet captains come to be admirals they ought to know something of their work.—*Engineer.*

With regard to the training of cooks for the navy, the secretary of the Admiralty states that there are three cookery schools, one at each of the principal home ports. Here the best methods of cooking whatever articles are supplied in naval rations are taught. Improved arrangements have also made so as to enable each mess to prepare its own tea. And to the present scale of seamen's mess utensils, knives, forks, basins, and plates of improved pattern are to be added.—*Army and Navy Gazette.*

The newest and one of the best dry docks in the United States has been completed at Hunter's point, San Francisco. It is the property of the San Francisco Dry Dock Company, and has been about two years in building. The dimensions are: length, 750 feet; width at top, 122 feet; width on a level with the top of the keel blocks, 80 feet; depth of water at high tide, 28 feet. It was built by Mr. Howard Holmes, and can comfortably accommodate the largest vessel afloat. When the pontoon gate is closed the water is withdrawn by three centrifugal pumps, having a combined capacity of 120,000 gallons per minute. During a recent docking of the battleship Ohio the dock was emptied in two hours and five minutes from the time the pumps were stated.—*Page's Magazine.*

A syndicate of American engineers with native divers and mechanics has succeeded in raising the warship Reina Cristina, the flagship of Admiral Montojo, which was sunk by the fleet under Admiral Dewey in Manila Bay on May 1, 1898. There is a great hole in the vessel's bow which was probably made by an 8-inch shell. There are fourteen smaller holes in the hull. Inside the hull the vessel is badly warped from the fire which was raging as she went down and is filled with a mass of engine-room wreckage. Many skeletons, estimated to number about eighty, rest in the mud in the bows, where the hospital, in which an eight-inch shell exploded, was situated. A sword was found under the bridge near a skeleton, which is supposed to be that of Captain Cadalzo. Admiral Montojo had just transferred his flag to the Isla de Cuba and Captain Cadalzo had given the order to abandon the flaming Reina Cristina when he was killed.

The main ejection valves and the valves for flooding the magazines are open, indicating that the Reina Cristina was scuttled like the other ships. No treasure was discovered in the wreck except a few lumps of gold, which, it is supposed, were the commander's watch and the ornaments of the chapel. The gradual removal of the mud disclosed other skeletons in the stern of the Reina Cristina. Commandant Cowden has placed a marine guard over the remains, and it is proposed to accord them a naval funeral at Cavite.

The syndicate expects to succeed in raising two other wrecks of Admiral Montojo's fleet within a month. Most of the guns were removed from these vessels by the insurgents, in the presence of Admiral Dewey's fleet, previous to the surrender of Manila, and many of them were repaired and afterward used against the American troops.—*Nautical Gazette.*

THE CRUISE OF THE SPARTIATE.—The first-class cruiser Spartiate which left Portsmouth on the 26th February with relief crews for the China station, arrived at Hong-Kong on the 8th inst., having averaged 13 knots, her ordinary cruising speed, on the way out. She has burnt less coal

apparently, than any other warship, British or foreign, which has ever visited Hong-Kong, altogether 2600 tons, which gives an average of 2 lbs. per I. P. H. for all purposes, and as she carries 2100 tons, she thus has a radius of action of 8000 miles at 13 knots. Her sister ship, the Amphitrite, on the same voyage, at an average speed of 13 knots, consumed 3900 tons, but this is hardly a fair criterion, as she visited the persian Gulf en route; it is, however, noteworthy that the first-class cruiser Blenheim, which is fitted with the old Scotch boilers, consumed on the same cruise nearly 4000 tons for an average speed of under 12 knots.—*Times.*

The experiments intended to determine the practicability of preserving steam coal by immersion in sea water were begun at Portsmouth the end of last week. Twenty-one tons were selected from the same stack and divided into three lots, two of ten tons and one of one ton. The ten ton lots are to be further divided, five perforated cases each containing two tons being submerged while five mounds each of two tons will be protected on shore by tarpaulins. The one ton lot is to be burned when the calorific and evaporative qualities are to be carefully noted by the officers who are entrusted with the trials. No further test will be made for twelve months, when one of the submerged lots will be tried in competition with one of the mounds stored on shore, and the results will be compared with those obtained at the combustion of coal drawn fresh from the stack. Further trials with the selected coal will be made from time to time as the officers responsible for the experiments may direct.—*Army and Navy Gazette.*

An interesting full-power trial has been made by all the ships of the Mediterranean squadron, and no doubt is possible as to the superior performance of the vessels with Belleville boilers. On an extended run, it was found that the vessels with the water-tube boilers consumed from 1.7 lbs. to 2 lbs. of fuel per indicated horsepower per hour, while in the case of the ships with cylindrical boilers the rate varied between 2.2 lbs. and 2.9 lbs. At the same time, the speed of the Belleville boiler ships was in some cases 3.5 miles per hour greater, and in no case was the excess speed less than 1½ miles. It is true that the water-tube boiler ships are newer, but the cylindrical boiler vessels were built originally to steam as fast, and it must be acknowledged that the difference is due almost entirely to the superiority of the water-tube system in generating a greater volume of steam for a given weight, and on the trial nearly all of them were blowing off steam. An even more significant fact is that the commander-in-chief, Admiral Domvile, who, it will be remembered, was President of the Water-Tube Boiler Committee, in selecting the ships to escort the King's yacht from Malta to Naples, had to confine himself to Belleville boiler ships, as none of the others could keep pace with the 18-knot speed of the Royal yacht, while at Naples all the ships gathered to honor the visit were of the water-tube boiler classes, with the exception of the Diana. On the run from Cherbourg to Portsmouth, too, the two Belleville boiler cruisers with the Royal yacht, which also has the water-tube steam generators, outpaced the two ships with cylindrical boilers, and arrived at Spithead first.

Now that the engine-room staffs are gaining experience very little is heard of defects, and the only criticism now heard is that the water-tube boiler was introduced at too rapid a rate to suit the training and experience of the naval officers, as the conditions of working were so essentially different. But that is rectifying itself very quickly. The only danger now from indifferent treatment is the possibility of pitting, especially in the economizer tubes; but pitting is not peculiar to Belleville economizers, as it exists in nearly every type of water-tube boiler, and in many forms of locomotive marine boilers. Again, the average coal cosumption in harbor

of the water-tube boiler ships is from 1 to 2 tons less per day than that of other ships. The water loss difficulty is being overcome, and now some of the Belleville boiler ships in commission are using much less water than their cylindrical sisters, so that altogether as the engine-room personnel gets experience the wisdom of the engineer-in-chief in introducing water-tube boilers will be more fully realized.—*Army and Navy Gazette.*

THE STEEL FLOATING DRY DOCK FOR THE PHILIPPINES.—Washington D. C., March 17, 1903.—The Bureau of Yards and Docks of the Navy Department on the 14th inst. opened bids for a self docking steel floating dry dock for the United States naval station at Cavite, Philippine Island, having a lifting capacity of not less than 16,000 gross tons and designed to dock the largest battle ships of the navy. Three bids were submitted, but owing to the various alternative propositions it will require careful examination by the special board having the matter in hand to determine the award. Bids were solicited on the basis of five separate items as follows: Items 1, price for dock and appurtenances delivered and moored at Cavite ready for operation and the time required for such delivery; Item 2, price for dock, moorings and appurtenances delivered at the works of the contractor ready for towing, and insured by the contractor for delivery at Cavite; Item 3, price for the dock, moorings and appurtenances delivered at the works of the contractors ready for towing and without insurance; Item 4, price for towing the dock from the works of the contractor and delivering and mooring at Cavite; Item 5, in case the bids on any of the above items exceed the appropriation available, an opportunity is given under this item to submit alternate proposals for completing the works within the appropriation. The bidders and their proposals were as follows:

United States Shipbuilding Company, Jersey City, N. J.—Item 1, $1,443,000, the dock to be delivered in 27 months at Cavite; Item 3 (*a*), $1,184,000, dock to be delivered at Wilmington, Del., (*b*), $1,220,000, dock to be delivered at San Francisco; Item 5, $1,100,000, dock to be complete and delivered, knocked down and ready for shipment.

Maryland Steel Company, Sparrows Point, Md.—Item 3 (*a*), $1,085,000; (*b*), $1,164,000; (*c*), $1,124,000; (*b*), $1,215,000, according to various plans submitted.

Chauncey L. Dutton, Yonkers, N. Y.—Item 3, $1,105,000, with an additional $100,000 to cover cost of testing, &c.; Item 5, $910,000, with $170,000 or $310,000 added for appurtenances, testing, &c., according to alternate plans.

The general features of the dock, together with the requirements as to the structural steel and iron employed, which are of special interest in view of the possible importation of this material, are specified by the Navy Department as follows:

General Requirements.—General Description.—The dock in general shall be so designed and arranged as to be readily self docking without the aid of divers or auxiliary constructions. It shall be self contained as to operating machinery, and capable of being towed from place to place safely without auxiliary bracing. It shall be of the general type composed of water tight side walls and body, or pontoons, with a general shaped cross section, and divided into sufficient water tight compartments to give great stability, there being not less than six transversely. Simplicity and certainty of operation and freedom from possible disablement in all operations should be given careful consideration by resigners.—*Iron Age.*

THE ADVANTAGES OF IN-TURNING SCREWS ON WARSHIPS.—Of late years there has been considerable discussion in naval circles upon the question as to whether it is more advantageous to have the screws of twin-screws vessels turn, as regards the movement of the top blades, inward toward the

vessel, or outward from it. All of the present battleships of the United States navy have outward-turning screws, that is to say, during the upper half of the revolution of the blades they are moving away from the longitudinal axis of the ship. As a result of this arrangement, our ships have shown excellent maneuvering power—a fact which has forced itself on the attention of English naval officers, who mention the fact that during the last West Indian cruise their own battleships with inward-turning screws were inferior in maneuvering ability to our own. It is a curious fact that this inferiority appeared to be noticeable only when the vessels were maneuvering from a state of rest. Naval Constructor Taylor has prepared a diagram a copy of which we are enabled by the courtesy of the Chief constructor of the navy to reproduce herewith, which shows that there is a decided advantage in outward-turning screws in enabling a vessel to turn more rapidly when she starts from rest.

It is known that as ordinarily fitted, the effect of a screw working when the vessel has not steerage way is to throw the stern transversely in the direction in which the upper blades of the screw are moving. This is because the upper blade does not get so good a grip on the water, and

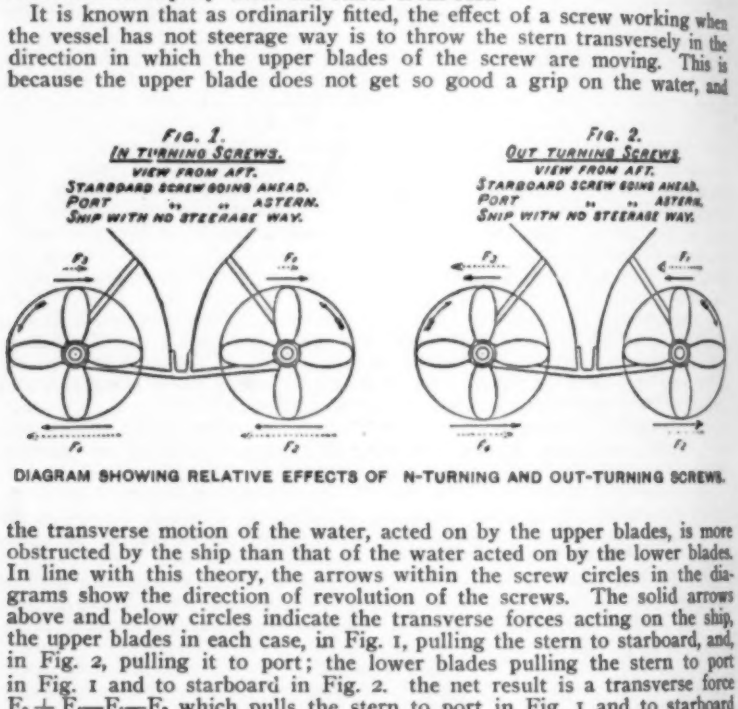


DIAGRAM SHOWING RELATIVE EFFECTS OF IN-TURNING AND OUT-TURNING SCREWS.

the transverse motion of the water, acted on by the upper blades, is more obstructed by the ship than that of the water acted on by the lower blades. In line with this theory, the arrows within the screw circles in the diagrams show the direction of revolution of the screws. The solid arrows above and below circles indicate the transverse forces acting on the ship, the upper blades in each case, in Fig. 1, pulling the stern to starboard, and, in Fig. 2, pulling it to port; the lower blades pulling the stern to port in Fig. 1 and to starboard in Fig. 2. the net result is a transverse force $F_2 + F_4 - F_1 - F_3$ which pulls the stern to port in Fig. 1 and to starboard in Fig. 2. The result of the thrusts on the screws is a force tending to pull the stern to starboard both in Fig. 1 and Fig. 2. The final resultant then of the transverse forces and thrusts developed by the screws is in Fig. 1 the difference of two forces, and necessarily less than either, while in Fig. 2 it is the sum of two forces, and necessarily greater than either.

If the propeller shafts, as they proceed aft from the engine, diverge, each upper blade meets the water at a smaller angle in Fig. 1 and at a greater angle in Fig. 2 than it would if the shafts were parallel; while each lower blade meets the water at a greater angle in Fig. 1 and at a smaller angle in Fig. 2. The dotted arrows outside the circles indicate the resulting changes in the transverse forces, and it is evident that the transverse forces acting against the screw thrusts are, in Fig. 1, strengthened; while

the transverse forces acting to help the screw thrusts are, in Fig. 2, weakened.

The conclusions to be drawn from the above are: First, that in-turning screws reduce or nullify entirely the maneuvering powers under engines alone of twin-screw ships, when they have no steerage way. Secondly, that shafts diverging the engines are inferior as regards maneuvering to parallel shafts, and shafts converging from the engines are superior in this respect to parallel shafts.—*Scientific American.*

The navel board on construction has decided that the new battleships Vermont, Kansas and Minnesota shall have outboard turning screws, a change from the inboard turning screws of the sister ships, the Connecticut and the Louisiana, and a return to the screw arrangement in vogue before the Connecticut and the Louisiana were designed. Rear Admiral Melville, Chief of the Bureau of Steam Engineering, objected to the change on several grounds, but was outvoted. It was demonstrated some time ago that vessels with inboard turning screws could make speed slightly better than they could if fitted with outboard turning screws and that was the reason of their adoption for the Connecticut and Louisiana. When Admiral Dewey's fleet was in the West Indies last winter comparative observations were taken which appeared to show that the outboard turning screws permitted the vessel to turn in a shorter arc than a vessel fitted with the other screws, and the advantage was marked by greater inturns from a standstill. British naval officers who witnessed part of the maneuvers frankly acknowledged that the outboard turning screws made the American vessels superior to British vessels in maneuver. In the opinion of a majority of the Board on Construction the advantage in turning more than compensated for the slight additional speed given by screws turning inboard.—*Nautical Gazette,* March 26.

THE DEFENCES OF PORT ARTHUR.—In a recent issue of the *Navy and Army Illustrated,* Mr. Alan H. Burgoyne, F. R. G. S., gives a striking account of Port Arthur, which is described as "well nigh impregnable as Gibraltar, both landwards and from the sea. The site of the old Chinese city is rapidly becoming a mass of barracks, and the extensive military works at present being carried out on all the surrounding heights testify to Russia's firm intention to retain Port Arthur for all time.

"The defences of the adjacent coast are remarkable, and extend in the nothern direction for a distance of forty versts, whilst to the south the sea-line is fortified along twelve versts. These fortifications take the form of earth batteries, and mount either three or four heavy guns each; the approach to them on the land side is made impossible by the erection about the bases of the hills on which they are situated, of stout fences, or, in many cases, castellated walls, with sentries placed in profusion around them to prevent any inquisitive stranger from approaching too near. These two long lines are joined by a circle of forts surrounding the town and surmounting the tops of the hills which are scattered over the country. The huge, scarcely finished, fort commanding the entrance has just received four new 63-ton breech-loading cannon on fortress mountings, whilst on the side towards the sea, and halfway between the crest of the hill and the water level are two batteries of small quick-firers, with a torpedo and search-light station, the combination making the success of an attack by torpedo vessels highly problematical.

"As one enters the harbor a large semi-natural break-water is seen on the left, enclosing a fine bay of about two miles in length by one mile in breadth. On this is placed a battery of seven 5.5-inch Canet quick-firers, at an elevation of not more than 10 feet from the mean sea-level, thus efficiently protecting the inner harbor and basin from any torpedo craft that might by chance have escaped the fire of the outer batteries."

LIST OF MEMBERS.

HONORARY MEMBERS.

Honorable William H. Moody, Secretary of the Navy (ex-officio).
President Charles W. Eliot, LL. D., Harvard University.
President D. C. Gilman, LL. D., Johns Hopkins University.

LIFE MEMBERS.

Brown, A. D.,	Commander,	U. S. N.	Prize Essayist, 1879.
Very, E. W.,	Late Lieut.,	U. S. N.	Prize Essayist, 1881.
Kelley, J. D. J.,	Commander,	U. S. N.	Prize Essayist, 1882.
Calkins, C. G.,	Commander,	U. S. N.	Prize Essayist, 1883 and 1886.
Chambers, W. I.,	Lieut.-Comd'r,	U. S. N.	Prize Essayist, 1884.
Farquhar, N. H.,	Rear-Admiral,	U. S. N.	Prize Essayist, 1885.
Hutchins, C. T.,	Captain,	U. S. N.	Prize Essayist, 1887.
Niblack, A. P.,	Lieut.-Comd'r,	U. S. N.	Prize Essayist, 1891 and 1896.
Clowes, Sir W. L.			Prize Essayist, 1892.
Schroeder, Seaton,	Captain,	U. S. N.	Prize Essayist, 1894.
Wainwright, R.	Captain,	U. S. N.	Prize Essayist, 1895.
Smith, R. C.,	Lieut.-Comd'r,	U. S. N.	Prize Essayist, 1897.
Goodrich, C. F.,	Captain,	U. S. N.	Prize Essayist, 1898.
Jackson, R. H.,	Lieutenant,	U. S. N.	Prize Essayist, 1900.
Hood, John,	Lieut.-Comd'r,	U. S. N.	Prize Essayist, 1901.
Alger, Philip R.,	Professor,	U. S. N.	Prize Essayist, 1903.

Acland, F. E. D., Captain, 76 Cheapside, London, E. C., England.
Acland, Rear-Admiral Sir William, H. B. M. Royal Navy, The Mount, Gibraltar.
Andrews, Philip, Lieutenant, U. S. N.
Bailey, F. H., Lieut.-Commander, U. S. N.
Barclay, Charles J., Captain, U. S. N.
Barker, Albert S., Rear-Admiral, U. S. N.
Beecher, Albert M., Lieutenant, U. S. N.
Bicknell, George A., Captain, U. S. N.
Bierer, Bion B., Lieutenant, U. S. N.
Bixby, William H., Major, Corps of Engineers U. S. A.
Brown, Austin P., No. 1426 F Street, Washington, D. C.
Brownson, Willard H., Captain, U. S. N.
Burbank, Percy, Agent in Peru for the General Electric Co., of New York, Cassilla, 115, Lima, Peru.
Burgdorff, T. F., Lieut-Commander, U. S. N.
Canet, Gustave, Past President of Civil Engineers of France, 87 Avenue Henri Martin, Paris, France.
Capps, Washington L., Naval Constructor, U. S. N.
Carrington, H. S., Secretary, Sir Joseph Whitworth and Co., Limited, Ashton Road, Openshaw, Manchester, England.

Carroll, R. P., Knickerbocker Club, New York, N. Y.
Chandler, Lloyd H., Lieutenant, U. S. N.
Clayton, E. S., The American Cotton Oil Co., 27 Beaver Street, New York, N. Y.
Clover, Richardson, Captain, U. S. N.
Coghlan, Joseph B., Rear-Admiral, U. S. N.
Cooper, Theodore, Consulting Engineer, 21 East 21st Street, New York, N. Y.
Coryell, Miers, Consulting Engineer, 21 East 21st Street, New York, N. Y.
Custance, R. N., Rear-Admiral, H. B. M. Royal Navy, The Admiralty, Whitehall, London, England.
Dayton, James H., Captain, U. S. N.
Dewey, George, Admiral of the U. S. N.
Duncan, W. B., Jr., Havemeyer Building, New York, N. Y.
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Emmens, Stephen H.
Evans, E. T., Manager, Lake Superior Transit Co., Buffalo, N. Y.
Evans, Robley D., Rear-Admiral, U. S. N.
Fletcher, A., North River Iron Works, Hoboken, New Jersey.
Gates, H. G., Lieutenant, U. S. N.
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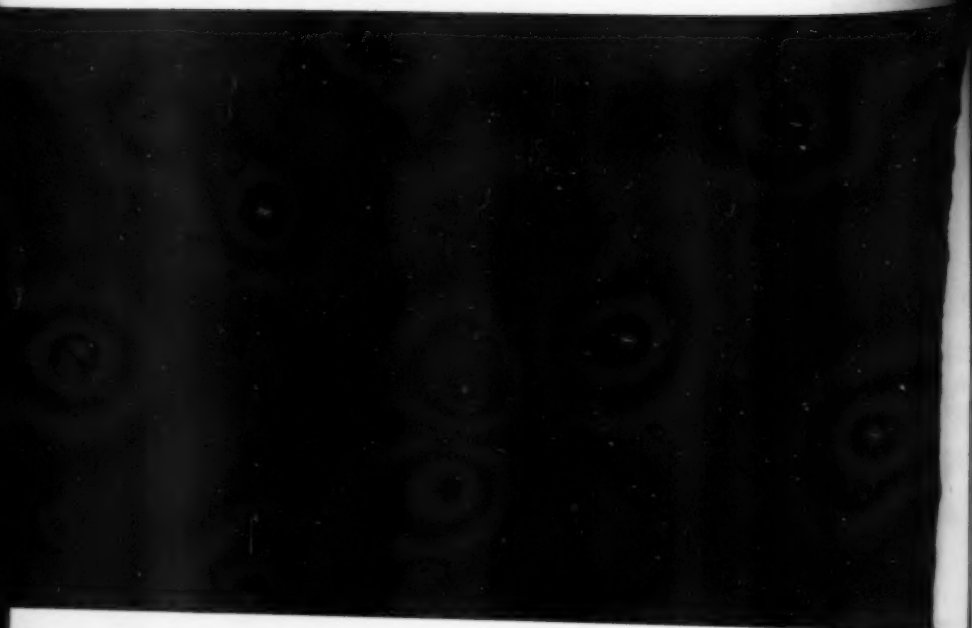

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* Subject to election at the next annual meeting.

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Russell, A. H., Lieut. Colonel, Chief Ordnance Officer, Division of the Philippines.
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Sverbeieff, Lieutenant, Imperial Russian Navy, Russian Cruiser Variag, Cronstadt, Russia.
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* Subject to election at the next annual meeting.

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Whistler, G. N., Major, Artillery Corps, U. S. A.
White, J. F., S. B., Buffalo Chemical Works, Buffalo, New York.
Wilkins, George S., University Post Office, Alabama.
Williams, C. S., 1st Lieutenant, Ordnance Corps, U. S. A.
Williams, Franklin D., Lieutenant, Naval Brigade, M. V. M., 85 Milk Street, Boston, Massachusetts.
Williams, J. W., Captain, Artillery Corps, U. S. A.
Wisser, John P., Major, Coast Artillery, U. S. A.
Woodall, James, Shipbuilder, Allen Street and Locust Point, Baltimore, Maryland.
Woodbury, John McGaw, M. D., 120 Fifth Avenue, New York, N. Y.
Yamanouchi, M., Captain, Imperial Japanese Navy, Director, Kure Arsenal, Kure, Japan.
Yarrow, Alfred F., Isle of Dogs, Poplar, London, E. C., England.
Zalinski, E. L., Captain, U. S. A.
Zogbaum, R. F., New Rochelle, New York.

LIST OF PRIZE ESSAYS.

1879.

Naval Education. Prize Essay, 1879. By Lieut.-Com. A. D. Brown, U.S.N.

NAVAL EDUCATION. First Honorable Mention. By Lieut.-Com. C. F. Goodrich, U.S.N.

NAVAL EDUCATION. Second Honorable Mention. By Commander A. T. Mahan, U.S.N.

1880.

"The Naval Policy of the United States." Prize Essay, 1880. By Lieutenant Charles Belknap, U.S.N.

1881.

The Type of (I) Armored Vessel, (II) Cruiser best suited to the Present Needs of the United States. Prize Essay, 1881. By Lieutenant E. W. Very, U.S.N.

SECOND PRIZE ESSAY, 1881. By Lieutenant Seaton Schroeder, U.S.N.

1882.

Our Merchant Marine: The Causes of its Decline and the Means to be taken for its Revival. "Nil clarius aquis." Prize Essay, 1882. By Lieutenant J. D. J. Kelley, U.S.N.

"MAIS IL FAUT CULTIVER NOTRE JARDIN." Honorable Mention. By Master C. G. Calkins, U.S.N.

"SPERO MELIORA." Honorable Mention. By Lieut.-Com. F. F. Chadwick, U.S.N.

"CAUSA LATET: VIS EST NOTISSIMA." Honorable Mention. By Lieutenant R. Wainwright, U.S.N.

1883.

How may the Sphere of Usefulness of Naval Officers be extended in Time of Peace with Advantage to the Country and the Naval Service? "Pour encourager les Autres." Prize Essay, 1883. By Lieutenant Carlos G. Calkins, U.S.N.

"SEMPER PARATUS." First Honorable Mention. By Commander N. H. Farquhar, U.S.N.

"CUILIBET IN ARTE SUA CREDENDUM EST." Second Honorable Mention. By Captain A. P. Cooke, U.S.N.

1884.

The Reconstruction and Increase of the Navy. Prize Essay, 1884. By Ensign W. I. Chambers, U.S.N.

1885.

Inducements for Retaining Trained Seamen in the Navy, and Best System of Rewards for Long and Faithful Service. Prize Essay, 1885. By Commander N. H. Farquhar, U.S.N.

1886.

What Changes in Organization and Drill are Necessary to Sail and Fight Effectively Our Warships of Latest Type? "Scire quod nescias." Prize Essay, 1886. By Lieutenant Carlos G. Calkins, U.S.N.

THE RESULT OF ALL NAVAL ADMINISTRATION AND EFFORT FINDS ITS EXPRESSION IN GOOD ORGANIZATION AND THOROUGH DRILL ON BOARD OF SUITABLE SHIPS. Honorable Mention. By Ensign W. L. Rodgers, U.S.N.

1887.

The Naval Brigade: its Organization, Equipment and Tactics. "In hoc signo vinces." Prize Essay, 1887. By Lieutenant C. T. Hutchins, U.S.N.

1888.

Torpedoes. Prize Essay, 1888. By Lieut.-Com. W. W. Reisinger, U.S.N.

1891.

The Enlistment, Training and Organization of Crews for our Ships of War. Prize Essay, 1891. By Ensign A. P. Niblack, U.S.N.

DISPOSITION AND EMPLOYMENT OF THE FLEET: SHIP AND SQUADRON DRILL. Honorable Mention, 1891. By Lieutenant R. C. Smith, U.S.N.

1892.

Torpedo-boats: their Organization and Conduct. Prize Essay, 1892. By Wm. Laird Clowes.

1894.

The U.S.S. Vesuvius, with Special Reference to her Pneumatic Battery. Prize Essay, 1894. By Lieut.-Com. Seaton Schroeder, U.S.N.

NAVAL REFORM. Honorable Mention, 1894. By Passed Assistant Engineer F. M. Bennett, U.S.N.

1895.

Tactical Problems in Naval Warfare. Prize Essay, 1895. By Lieut.-Com. Richard Wainwright, U.S.N.

A SUMMARY OF THE SITUATION AND OUTLOOK IN EUROPE. An Introduction to the Study of Coming War. Honorable Mention, 1895. By Richmond Pearson Hobson, Assistant Naval Constructor, U.S.N.

SUGGESTION FOR INCREASING THE EFFICIENCY OF OUR NEW SHIPS. Honorable Mention, 1895. By Naval Constructor Wm. J. Baxter, U.S.N.

THE BATTLE OF THE YALU. Honorable Mention, 1895. By Ensign Frank Marble, U.S.N.

1896.

The Tactics of Ships in the Line of Battle. Prize Essay, 1896. By Lieutenant A. P. Niblack, U.S.N.

THE ORGANIZATION, TRAINING AND DISCIPLINE OF THE NAVY PERSONNEL AS VIEWED FROM THE SHIP. Honorable Mention, 1896. By Lieutenant Wm. F. Fullam, U.S.N.

NAVAL APPRENTICES, INDUCEMENTS, ENLISTING AND TRAINING. The Seaman Branch of the Navy. Honorable Mention, 1896. By Ensign Ryland D. Tisdale, U.S.N.

THE COMPOSITION OF THE FLEET. Honorable Mention, 1896. By Lieutenant John M. Ellicott, U.S.N.

1897.

Torpedo-boat Policy. Prize Essay, 1897. By Lieutenant R. C. Smith, U.S.N.

A PROPOSED UNIFORM COURSE OF INSTRUCTION FOR THE NAVAL MILITIA. Honorable Mention, 1897. By H. G. Dohrman, Associate Member, U.S.N.I.

TORPEDOES IN EXERCISE AND BATTLE. Honorable Mention, 1897. By Lieutenant J. M. Ellicott, U.S.N.

1898.

Esprit de Corps: A Tract for the Times. Prize Essay, 1898. By Captain Caspar Frederick Goodrich, U.S.N.

OUR NAVAL POWER. Honorable Mention, 1898. By Lieut.-Com. Richard Wainwright, U.S.N.

TARGET PRACTICE AND THE TRAINING OF GUN CAPTAINS. Honorable Mention, 1898. By Ensign R. H. Jackson, U.S.N.

1900.

Torpedo Craft: Types and Employment. Prize Essay, 1900. By Lieutenant R. H. Jackson, U.S.N.

THE AUTOMOBILE TORPEDO AND ITS USES. Honorable Mention, 1900. By Lieutenant L. H. Chandler, U.S.N.

1901.

Naval Administration and Organization. Prize Essay, 1901. By Lieutenant John Hood, U.S.N.

1903.

Gunnery in Our Navy. The Causes of its Inferiority and Their Remedies. Prize Essay, 1903. By Professor Philip R. Alger, U.S.N.

A Naval Training Policy and System. Honorable Mention, 1903. By Lieutenant James H. Reid, U.S.N.

Systematic Training of the Enlisted Personnel of the Navy. Honorable Mention, 1903. By Lieutenant C. L. Hussey, U.S.N.

Our Torpedo-Boat Flotilla. The Training Needed to Insure its Efficiency. Honorable Mention, 1903. By Lieutenant E. L. Beach, U.S.N.

NOTICE.

The U. S. Naval Institute was established in 1873, having for its object the advancement of professional and scientific knowledge in the Navy. It now enters upon its twenty-eighth year of existence, trusting as heretofore for its support to the officers and friends of the Navy. The members of the Board of Control cordially invite the co-operation and aid of their brother officers and others interested in the Navy, in furtherance of the aims of the Institute, by the contribution of papers and communications upon subjects of interest to the naval profession, as well as by personal support and influence.

On the subject of membership the Constitution reads as follows:

ARTICLE VII.

Sec. 1. The Institute shall consist of regular, life, honorary and associate members.

Sec. 2. Officers of the Navy, Marine Corps, and all civil officers attached to the Naval Service, shall be entitled to become regular or life members, without ballot, on payment of dues or fee to the Secretary and Treasurer, or to the Corresponding Secretary of a Branch. Members who resign from the Navy subsequent to joining the Institute will be regarded as belonging to the class described in this Section.

Sec. 3. The Prize Essayist of each year shall be a life member without payment of fee.

Sec. 4. Honorary members shall be selected from distinguished Naval and Military Officers, and from eminent men of learning in civil life. The Secretary of the Navy shall be, *ex officio*, an honorary member. Their number shall not exceed thirty (30). Nominations for honorary members must be favorably reported by the Board of Control, and a vote equal to one-half the number of regular and life members, given by proxy or presence, shall be cast, a majority electing.

Sec. 5. Associate members shall be elected from officers of the Army Revenue Marine, foreign officers of the Naval and Military professions, and from persons in civil life who may be interested in the purposes of the Institute.

Sec. 6. Those entitled to become associate members may be elected life members, provided that the number not officially connected with the Navy and Marine Corps shall not at any time exceed one hundred (100).

Sec. 7. Associate members and life members, other than those entitled to regular membership, shall be elected as follows: "Nominations shall be made in writing to the Secretary and Treasurer, with the name of the member making them, and such nominations shall be submitted to the Board of Control, and, if their report be favorable, the Secretary and Treasurer shall make known the result at the next meeting of the Institute, and a vote shall then be taken, a majority of votes cast by members present electing.

The Proceedings are published quarterly, and may be obtained by non-members upon application to the Secretary and Treasurer at Annapolis, Md. Inventors of articles connected with the naval profession will be afforded an opportunity of exhibiting and explaining their inventions. A description of such inventions as may be deemed by the Board of Control of use to the service will be published in the Proceedings.

Single copies of the Proceedings, $1.00. Back numbers and complete sets can be obtained by applying to the Secretary and Treasurer, Annapolis, Md.

Annual subscriptions for non-members, $3.50. Annual dues for members and associate members, $3.00. Life membership fee, $30.00.

All letters should be addressed to Secretary and Treasurer, U. S. Naval Institute, Annapolis, Md., and all checks, drafts and money orders should be made payable to his order, without using the name of that officer.

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SPECIAL NOTICE.

NAVAL INSTITUTE PRIZE ESSAY, 1904.

A prize of two hundred dollars, with a gold medal, and a life-membership in the Institute, is offered by the Naval Institute for the best essay presented on any subject pertaining to the naval profession, subject to the following rules:

1. The award for the prize shall be made by the Board of Control, voting by ballot and without knowledge of the names of the competitors.

2. Each competitor to send his essay in a sealed envelope to the Secretary and Treasurer on or before January 1, 1904. The name of the writer shall not be given in this envelope, but instead thereof a motto. Accompanying the essay a separate sealed envelope will be sent to the Secretary and Treasurer, with the motto on the outside and writer's name and motto inside. This envelope is not to be opened until after the decision of the Board.

3. The successful essay to be published in the Proceedings of the Institute; and the essays of other competitors, receiving honorable mention, to be published also, at the discretion of the Board of Control; and no change shall be made in the text of any competitive essay, published in the Proceedings of the Institute, after it leaves the hands of the Board.

4. If, in the opinion of the Board of Control, the best essay presented is not of sufficient merit to be awarded the prize it may receive "Honorable Mention" or such other distinction as the Board may decide.

5. In case one or more essays receive "Honorable Mention," the writer of the first of them in order of merit will receive seventy-five dollars and a life-membership in the Institute.

6. Any essay not having received honorable mention, may be published also, at the discretion of the Board of Control, but only with the consent of the author.

7. The essay is limited to fifty (50) printed pages of the Proceedings of the Institute.

8. All essays submitted must be either type-written or copied in a clear and legible hand.

9. In the event of the Prize being awarded to the winner of a previous year, a gold clasp, suitably engraved, will be given in lieu of the gold medal.

By direction of the Board of Control.

PHILIP R. ALGER,
Professor, U. S. N., Secretary and Treasurer.